ELECTRICAL WORLD

SEPTEMBER 26, 1935

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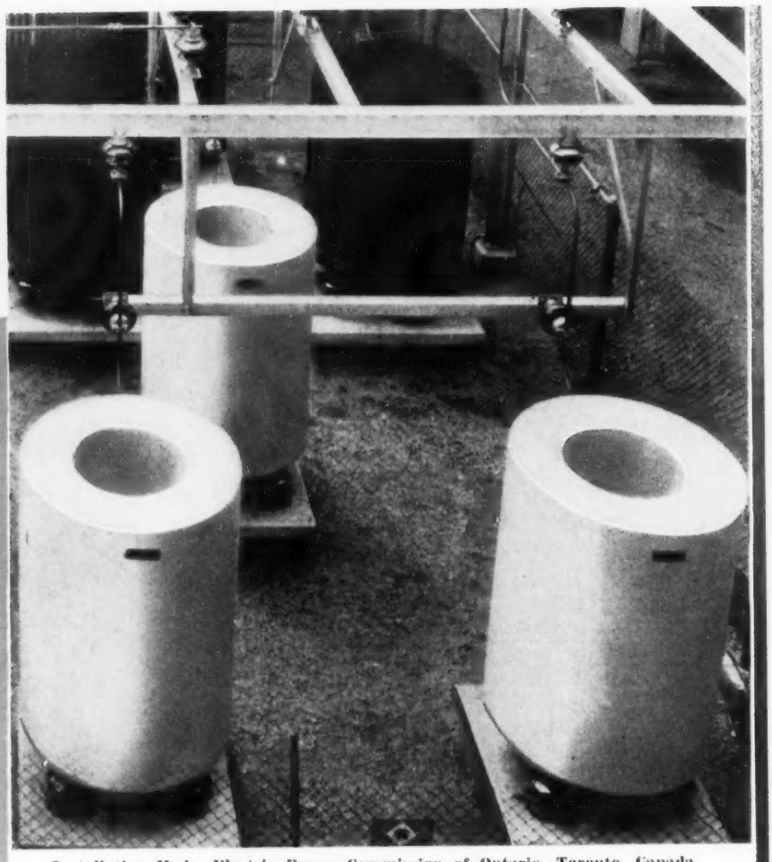

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SEPTEMBER 26, 1931

Contents Copyrighted, 1931, by McGraw-Hill Publishing Company, Inc.

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Electrical World articles are indexed in Industrial Arts and Engineering Indexes, available in public libraries

McGRAW-HILL PUBLISHING COMPANY, INC., Tenth Ave. at 36th St., New York, N. Y.

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CABLE ADDRESS: *"Machinist, N. Y."*

Published weekly. $5 per year. 25 cents per copy. Entered as second-class matter, January 20, 1907, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

Member A.B.C.
Member A.B.P.

NUMBER OF COPIES PRINTED THIS ISSUE, 17,125

NEW YORK District Office, 285 Madison Avenue
WASHINGTON, National Press Building
CHICAGO, 520 N. Michigan Avenue
PHILADELPHIA, 1600 Arch Street
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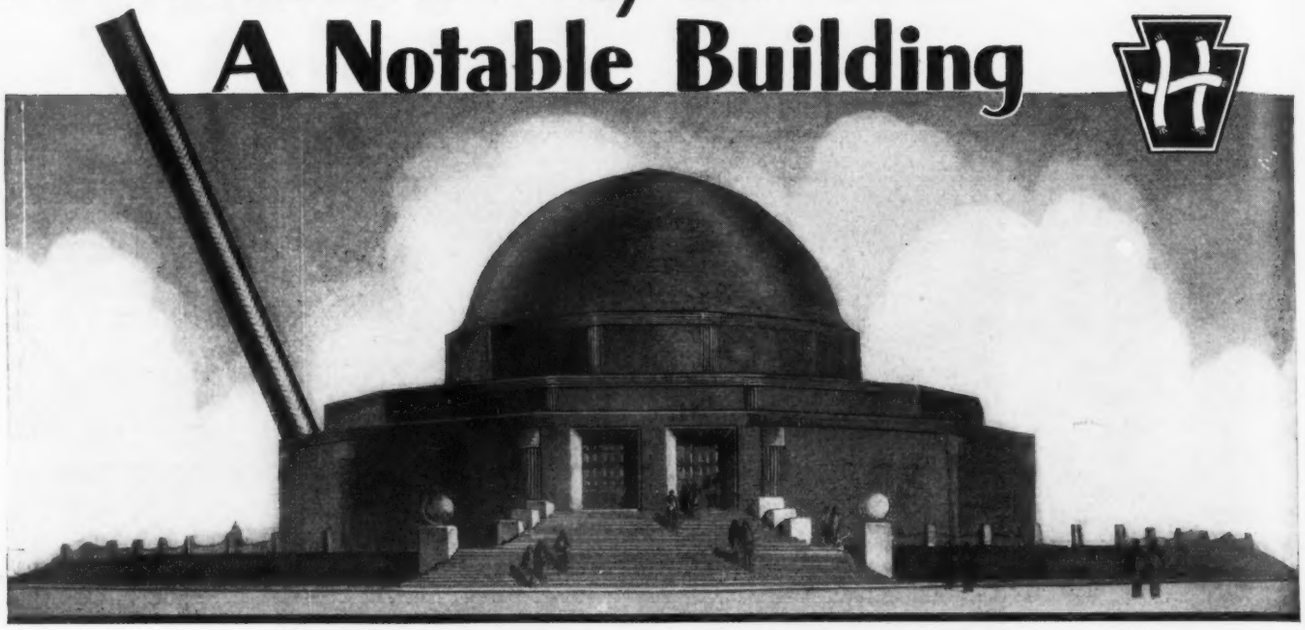

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ELECTRICAL WORLD

for the Week Ending

September 26, 1931

Federal Trade Commission reaches Standard Gas & Electric Company

Harris Ewing—Wide World

Next to recklessness at the top of a boom the most foolish thing in the world is discouragement at the bottom of a slump.

ROGER W. BABSON,
Statistical Economist.

—**Hearings to resume next week** with Byllesby subsidiary as the storm center. Federal Trade Commission still going strong on long-drawn-out program, following a style all its own—*p. 530.*

—**Transmission trends analyzed** to obtain indications of ruling tendencies. Study reveals close agreement of engineers upon design principles followed in American practice—*p. 553.*

Motors stopped in three revolutions

—**Dynamic control of drives** for industrial processes improved and made more effective. Synchronous motors may be stopped in three revolutions by plan eliminating coasting time—*p. 556.*

—**High pressures perform well** in California station, reports engineer. Cost no greater. Operating difficulties few. Flexibility and fuel economy over low-pressure plants demonstrated—*p. 544.*

—**3,200-lb. boiler pressures?** Tests at Purdue University under auspices of American Society of Mechanical Engineers and several manufacturers point to possible commercial development of hitherto fabulous pressures—*p. 532.*

Sloan reviews status of industry

—**Face the future fearlessly** is the admonition of M. S. Sloan, who sees commercially active industry increasing energy sales to more sympathetic populace. Investment values secure—*p. 549.*

—**Frequency-changer stability** important in intra-system ties is conclusion of Commonwealth Edison engineers, who define limits as established by careful tests on that system—*p. 558.*

—**Government ownership means** political slavery, Governor Ritchie told the American Bar Association. Maryland chief executive's protest against unwarranted attacks on power industry acclaimed *pp. 540 and 537.*

Shoals decision up to Hoover

Radio-Tube Fight Brings Agreement of R. C. A. and Independents

LONG-STANDING contention between the Radio Corporation of America on the one hand and 21 independent manufacturers of radio tubes, chief among them the De Forest Radio Company, on the other has ended through an agreement, announced on September 23, providing for cross-licenses to use patents. Payment to the De Forest Radio Company of a cash sum stated by the president of that company, C. G. Munn, to be $1,000,000 was involved. The understanding reached terminates both the suits brought against the independent manufacturers by the Radio Corporation for infringement of patent and the counter-suits brought by independent companies against the R. C. A. for restraining trade in violation of the Clayton act. The latter are said to have totaled $47,000,000 in damages sought. It is noteworthy, however, that the Grigsby-Grunow Company, manufacturer of the Majestic radio products, which is suing the R. C. A. for $30,000,000, is not included in the independent companies listed by their counsel as parties to the agreement.

The settlement follows the decision of the United States Supreme Court last May finding invalid the Langmuir patents on which the Radio Corporation's assertion of infringement was based and sustaining the De Forest company, which had fought the case up to the supreme tribunal. Whether it will lead the federal government to discontinue its own suit against the R.C.A. for violation of the Clayton act, and bring about the establishment of a patent pool, remains to be seen.

▼

Muscle Shoals, Say Some, in President's Own Hands

ACCORDING TO AN ORAL statement made on September 19 at the Washington headquarters of the Muscle Shoals Commission, Attorney-General William D. Mitchell may be called upon in the near future for a ruling on the question whether President Hoover has authority under existing statutes to dispose of the government property at Muscle Shoals without further authorization from Congress. Certain legal advisers of the commission have reached the tentative opinion that the President is empowered to sell the federal plant at Muscle Shoals, it was explained.

This opinion is understood to be based on the national defense act of 1916 and the act of July 9, 1918, authorizing the President to sell war supplies, including plants and factories acquired after April 6, 1917, with the exception of Dam No. 2 at Muscle Shoals. The Federal Power Commission, it was added, has the power to dispose of this dam under the federal water power act of 1920, provided the Department of War chooses to turn over the dam to that commission.

This belated discovery of the alleged powers of the President over the Muscle Shoals white elephant did not, however, arouse a profound sensation at Washington or elsewhere. Prominent politicians interviewed appeared inclined to agree that it was "inconceivable," as Senator Walsh of Montana put it, that such authority, even if legally established, would be acted upon by the government and a bone of contention fought over in Congress for more than ten years thus snatched away from the legislators.

The Muscle Shoals Commission is now negotiating with three large chemical companies, according to Col. Joseph I. McMullen, a member of the commission. He said these companies have not previously figured in discussions and were not among the firms from which proposals were received in Washington September 1. He added that the commission hopes to have "something definite to work on" when it meets October 1 in Birmingham. Colonel McMullen predicted that the commission would have a recommendation for the leasing of the plants in President Hoover's hands a full month before Congress meets in December. He indicated that the commssion would recommend that the plants be leased to a chemical rather than a power company, since it was primarily interested in having the plants operated for production of cheap fertilizer.

Not daunted by the failure of the suit instituted by Alabama two years ago to collect $1,000,000 in back taxes from the United States government, Attorney-General McCall of that state has announced that he will soon file an injunction to restrain the federal government from selling Muscle Shoals power until it pays a license tax to Alabama.

▼

Federal Trade Hearings to Resume September 29

RESUMPTION OF THE Federal Trade Commission's, inquiry into financial and other phases of the electric and gas utility business is announced for Tuesday next, September 29. The affairs of the Standard Gas & Electric Company,

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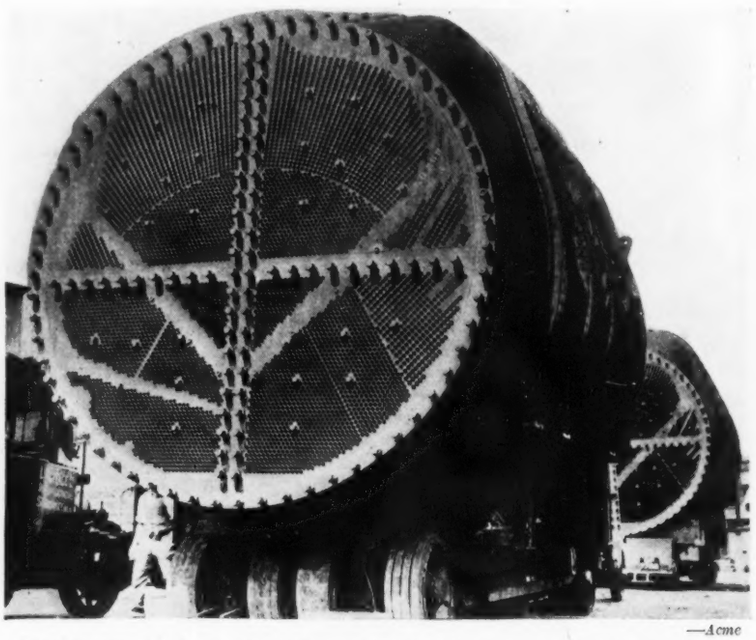
BATTERSEA STATION, LONDON, GETS LARGE CONDENSERS



—Acme

Condensers 20 ft. in diameter and weighing more than 30 tons each were recently brought to this new metropolitan power station. They are called the largest ever built in England.

Chicago, one of the large holding companies of the Byllesby group, will be examined. Special experts employed by the commission, who have made a survey of the company's records, will testify.

▼

Electric Welding Strides Demonstrated at Boston

FIVE ENGINEERING SOCIETIES assembled at Boston this week for a National Metal Congress and Exposition in which the latest advances in metallurgy, heat treating and welding were celebrated in a program embodying 24 technical sessions and a comprehensive display of equipment occupying an extended area on the Commonwealth Pier. More than 100 papers were presented, and speakers presented a large amount of evidence that electrical equipment is an invaluable auxiliary in the study and use of metals under laboratory and field conditions.

The American Welding Society held a convention during which it was repeatedly brought out that electric welding has now become a standard method for use in shop and field practice. A monumental report of 207 pages by the structural-steel welding committee of the American Bureau of Welding attracted widespread interest, the data exhaustively demonstrating the safety and basic value of standardized welding practice in the structural field, following five years' investigation by picked specialists representing many sections of the country. Notable examples of structural arc welding were described by G. D. Fish and F. P. McKibben, the former pointing out that on the new group of buildings under construction for Yale University the awarded contract price was about 13 per cent below the bids for a riveting job, and that the connections designed for arc welding weighed but 2.5 per cent of the total steel against a probable 5 per cent with riveting.

W. E. Stine discussed the control of aluminum oxides and other deleterious inclusions as factors in "quality" welding, asserting that proper fluxes and temperatures are vital to uniformly good work. J. Kjekstad reviewed the advantages of welded ship construction with special reference to meeting severe strains, saving space in tankers, forestalling corrosion and minimizing framing in certain types of cargo carriers. The indications are that the welded hull will outsell, outwork and outlive any other type of hull, the author declared. Improvements in the design of tool steel, studies of endurance properties of steel in steam, of thermomagnetic phenomena, copper embrittlement, crystal macrostructure of copper-wire bars, alloy characteristics and other topics enriched the sessions of the various societies, which included, in addition to the welding organization mentioned, the American Institute of Mining Engineers, American Society of Mechanical Engineers, American Society for Steel Treating and the Society of Automobile Engineers. Extracts from papers of electrical interest will be published in later issues of the ELECTRICAL WORLD.

WELDED STEEL FRAME COSTS $24 MORE THAN WOOD

—*Lincoln Electric Co.*

This arc-welded steel frame for a Cleveland residence (ELECTRICAL WORLD, *July 11, page 49) will, latest figures say, cost only $24 more than a wooden frame. The house has seven rooms and is of Norman French design.*

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Wisconsin Utilities Must Pay to Be Investigated

PUBLIC UTILITIES of Wisconsin have been notified by the Public Service Commission of that state of the items that will be charged against them in case of an investigation of their activities in accordance with the regulatory law passed by this year's Legislature, which provides that the utilities must bear the expense of investigations made by the commission.

The order states that no charges will be made for general overhead of the commission or the time of the general office staff or department heads engaged in supervisory work. The time of all persons assigned to the work and engaged thereon, whether in the offices of the commission or on the property of the public utility, will, however, be charged. If it is necessary to visit another state for the investigation or make an examination of affiliated interests, the cost will be charged to the utility. The utility must also pay traveling expenses, stationery and printing charges, and for the services of consultants and special employees. Charges will be made on an hourly basis.

Following the determination to investigate a utility, the utility may confer with the commission as to ways and means of eliminating duplication in research. Following the study a tentative bill will be submitted, and within ten days the utility may object or the bill will be considered satisfactory. If an objection is raised, a hearing will be held and then the commission will send out its final bill.

▼

Dominion and Quebec Men Confer on Beauharnois

AT THE CONCLUSION of a long conference in Ottawa on September 16 on the Beauharnois enterprise between Premier Bennett and representatives of the Quebec government it was given out that the project will go ahead and that the interests of bona-fide investors will be protected. No official statement was made, but it is held to be probable that with the elimination of the present directorate the existing company will be reorganized and the work carried on under some measure of Dominion control or supervision. Premier Taschereau of Quebec said: "We are in cordial agreement on all the main points at issue and on most of the steps to be taken to insure the delivery of power at the earliest possible time."

Busy Inspectors Meet at Pittsburgh and Dallas

BUSY SESSIONS, filled with the usual copious reports and discussions, article by article, on the National Electrical Code for 1931, were held from Monday to Friday last week by the Eastern and Western Sections of the International Association of Electrical Inspectors, meeting in Pittsburgh. In addition, papers and reports by specialists and experts were presented. The meeting was well attended.

Article 4, on services and service equipment, probably received more attention than any other, its interpretation seeming to present some difficulties, and appeals for greater clarity were made. No decided objection was raised to the revisions in Article 5, on wiring. This article appeared more acceptable than for years. Throughout the discussion of these and other articles of the code there was apparent a definite sentiment for uniform national practice and less desire for special local rules. V. H. Tousley in his address stressed these points.

Definite dissatisfaction was expressed with the existing situation regarding trial installations, on which reports were presented by W. E. Kern and C. W. Gustafson, and committee study by the international body and all the sections was urged, any plan evolved to be of such a nature as to call for its supervision by the I.A.E.I.

On Monday morning the two presidents, W. J. Mahan of the Eastern Section and A. G. Hall of the Western, were heard, following J. C. Forsyth, supervising engineer of the New York Board of Underwriters.

A talk by H. B. Kirkland emphasized the salient features of electrical inspection, license laws and ordinances. A. L. Abbott, speaking on procedure, particularly pointed out the error of continuing to install services and circuits of smaller capacity than experience has proved to be adequate.

J. E. Wise in dealing with the education of the public on inspectors' duties said that it should be possible for the general public to consult with inspectors concerning their wiring installations.

W. P. Dobson described laboratory testing and field inspection in Ontario and the nature and development of standards and alluded to trouble with sub-standard material from the United States.

C. W. Abbott interested the inspectors in the subject of better flexible cords with particular reference to the new labeled product. Unanimous support of the trade extension group's plan was pledged.

There was a novel "red-flame building" contest, in which 30 minutes was given competitors to report on faulty installation in a structure wired for the purpose.

Louis K. Comstock, president Electrical Guild of North America, addressed a joint meeting of the inspectors and the Electric League of Pittsburgh.

This week the Southern Section of the international association met at Dallas, Tex., and a program of the same general nature as that at Pittsburgh was carried out, prominent Southern utility men taking part.

▼

MINNEAPOLIS HAS LIGHTING CELEBRATION

Fifty years ago Minneapolis installed its first electric street-lighting system, consisting of seven arc lamps. An enterprising store recently commemorated this semi-centennial by installing seven 21,000,000-cp. searchlamps and a permanent varicolored floodlighting scheme, of which a small part is shown here.

▼

High-Pressure Experiments at Purdue Laboratories

PRESSURES OF 1,500 LB. per square inch and others as high as 3,200 lb. and 3,500 lb. are being applied to a boiler in the engineering laboratory of Purdue University, Lafayette, Ind., under the supervision of Prof. H. I. Solberg of the School of Mechanical Engineering. These experiments are being made with the co-operation of a committee of the American Society of Mechanical Engineers, and reports on the work thus far done will be submitted to the A.S.M.E. research committee at Purdue on October 2 and later to the annual meeting of the society in New York in December.

The experimental project was made possible by the co-operation of manufacturers and utilities, among them the Babcock & Wilcox Company of New York, which donated the boiler; the Crane Company of Chicago, the Commonwealth Edison Company, the Bailey Meter Company of Cleveland and the Fisher Governor Company of Marshalltown, Iowa. "We are looking ahead to the time when boilers will operate at a pressure of 3,500 lb.," said Dean A. A. Potter of the Schools of Engineering at Purdue, who also is director of the engineering experiment station. "A new principle in boiler design is being studied."

▼

Harding Street Plant, Indianapolis, Complete

COMPLETION OF THE 70,000-kw. Harding Street generating station of the Indianapolis Power & Light Company was reached on September 19. The new plant is a brick and steel building, 400 ft. long and 220 ft. wide. The plant houses two 35,000-kw. generators and auxiliary equipment. It has a concrete coal pit in which 50,000 tons of fuel may be stored under water. Fifty miles of 132-kv. cable form a loop around the city. Four substations have been built and two distributing stations, increasing the number of the latter to twelve.

The total cost is estimated at $12,000,000. The plant has been under construction for two years. Its completion virtually doubles the electrical energy available to the city and provides an extensive reserve.

▼

Pinchot Subordinates Power and Regulation

GOVERNOR GIFFORD PINCHOT of Pennsylvania states that because of the unemployment situation he will not carry out his previously announced intention to call a special session of the Legislature to consider public utility legislation again but will instead call a session to consider measures for the relief of unemployment.

"This is no time to complicate urgently needed legislation for unemployment relief by the long struggle which would be brought upon us by the inclusion of the public utility issue, important and necessary as consideration of it unquestionably is," the Governor says, adding: "Let it be understood, however, that I will see to it that the public utility issue is raised in every district in Pennsylvania at the primary election of 1932, as well as in the general election which follows it."

New England Power Builds Transmission-Line Links

IMPORTANT CONSTRUCTION JOBS are reported as completed recently by the New England Power Association. Among these is the 19-mile, 110-kw. transmission line from the association's Millbury (Mass.) switching station to Woonsocket, R. I., which provides a stronger tie between Millbury, the dispatching center of the New England Power system, and its steam-electric resources on Narragansett Bay.

The association has also constructed recently another 110-kv. transmission line which, while short, is strategically very important. This line runs from the hydro-electric plant of the Turners Falls (Mass.) Power Company on the Connecticut River $2\frac{3}{4}$ miles north to a direct connection with the Harriman-Millbury line of the New England Power System.

▼

Virginia and Kansas Towns Beat Bids for City Plants

SALE OF THE Farmville (Va.) municipal electric light plant to the Virginia Public Service Company for $500,000 and a 30-year franchise was defeated in a special election September 15 at which the largest popular vote in years was cast. A total of 486 votes was polled, 287 opposing the sale and 199 favoring it.

Voters of Oberlin, Kan., by 762 to 159, on September 12, rejected a proposal to sell its municipally owned light and power plant to the Central Kansas Power Company of Abilene.

The Tide Water Power Company will purchase the electric and water plants and distribution system of Beaufort, N. C., for $210,000, subject to a vote to be held October 13.

▼

City and Private Plant Wage Lively Rate War

A PETITION OF THE Texas Electric Service Company for a temporary injunction to restrain the city of Seymour from enforcing a recent ordinance fixing a minimum rate for electric service has been refused by the United States District Court at Dallas. The case will be tried at Wichita Falls at the November term. It is attracting much attention in public utility and municipal circles of Texas because of the legal questions involved. The company seeks to prevent Seymour, which has a municipal power plant, from fixing the minimum rate higher than the plaintiff's present rate. This, it is argued, will cause it to lose its business in Seymour and amounts to an illegal confiscation of property. The company claims that the city plant does not fill a government function but is run in a proprietary capacity to aid and protect a private business enterprise and that the regulation of rates is an unreasonable exercise of the police power.

Counsel for the city argued that cities of more than 2,000 population are allowed by the state to regulate rates. "The company," he said, "is asking that it be given the right to make Texas abrogate its rate-making powers to allow a private company to charge any rates to force a municipal plant out of business."

▼

Recent Court Cases in New England States

A HEATED ARGUMENT was made in court by Prof. Albert Levitt in supporting his counsel, who recently appealed to the Connecticut Supreme Court of Errors from the decision of the State Supreme Court that members of the Public Service Commission of that state should not be ousted for failure to enforce the law governing removal of grade crossings on railroads. Professor Levitt, seeking to intervene as a "friend of the court," called the decision a serious miscarriage of justice. Last week a decision was rendered to the effect that Professor Levitt could not qualify as a party in interest, the determination on whether to appeal being vested in the Attorney-General.

Disputing the power of the Connecticut Public Utilities Commission to compensate consumers for allegedly exorbitant rates in the past by imposing non-remunerative rates in the present, the Clinton Electric Light & Power Company has filed with the Superior Court of the state an appeal from the order reported in the ELECTRICAL WORLD for August 22 (page 311). The company pleads confiscation.

The New Hampshire Public Service

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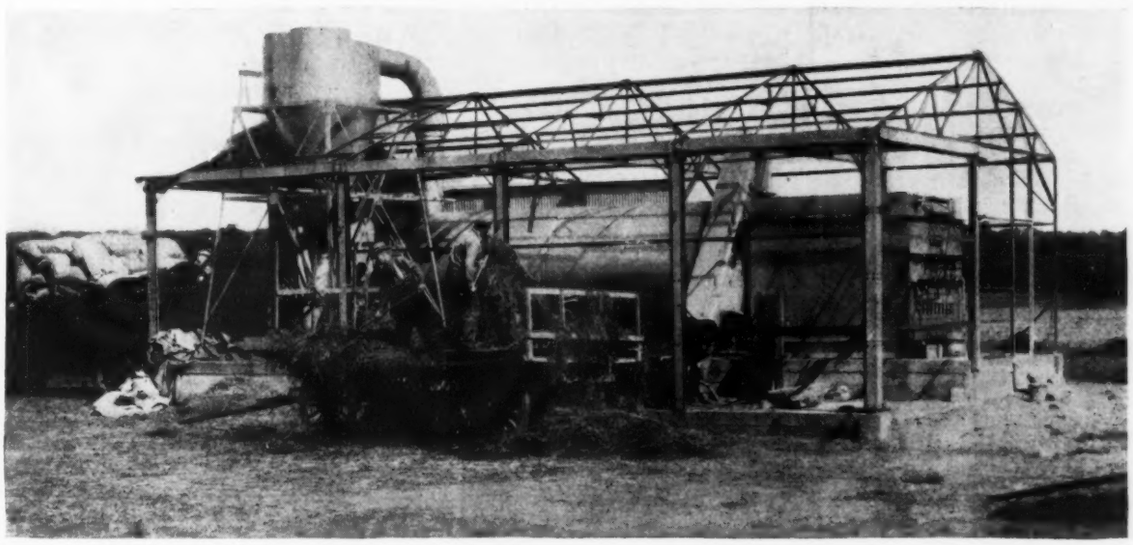
ELECTRICAL INNOVATORS SPOIL A TIME-HONORED PROVERB



Machines called "Ardriers" cure hay at E. A. Ashton's Ashgrove Farms, near Saratoga, N. Y., regardless of the once essential sun. Mr. Ashton has stored about 600 tons of alfalfa and hay, of which half would probably have been spoiled by rain without the aid of the new device, made by the Arnold Dryer Company, Milwaukee, and furnished with General Electric motors.

Commission's orders of uJne 30 resulting from a long investigation into the affairs of the New Hampshire Gas & Electric Company, Portsmouth, and the Derry Electric Company, both controlled by the New England Gas & Electric Association, were ordered effective forthwith on September 10. This action followed a hearing arranged to permit the utilities to submit further evidence in connection with the denial for a rehearing. Counsel argued against the move of the commission, stating that the case was still in the courts .

The Holyoke (Mass.) Water Power Company has won in litigation against it by the Whiting Paper Company charging that $200,000 paid in rentals had been used for general purposes and dividends instead of being devoted to the upkeep of the dam and canals. The Supreme Court of Massachusetts found no such obligation as that alleged and also determined in the water-power company's favor a counter suit charging the paper-manufacturing company with wrongful use of the water power.

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Rate Reductions Continue in Middle West States

A SWEEPING REDUCTION in rates is announced by the Central States Power & Light Corporation, associated with the Interstate Power Company, both of Dubuque, Iowa. The reduction will affect 67 cities and towns in the northeastern section of that state. It comes after a two months' study of the territory served. Approximate reduction is about 10 per cent, with a variance in different classes. Cities and towns are rated in three classes as to light rates only, at 11 cents, 10 cents and 9 cents as the kilowatt-hour rate for the first step.

The City Council of Sedalia, Mo., has accepted the offer of the City Light & Traction Company for a reduction in electric rates. An appraisal by the Missouri Public Service Commission is under way, but under the agreement with the Council the commission will be asked to abandon it. Under the new rates the service charge to domestic consumers is cut from $1 to 75 cents and the rate will be 5 cents a kilowatt-hour for the first 30 kw.-hr. in any month and 3 cents for any excess. The old rate was 5 cents for the first 50 kw.-hr. The new schedule also effects a reduction in commercial, retail power and other schedules.

Negotiated rates continue to be the order of the day in Kansas. The Kansas Utilities Company, the first of the electric companies in Kansas to announce a general reduction in electric rates, announced seven weeks ago a reduction of from 8 to 12 per cent. The schedule filed last week shows actual reductions to be from 9 to 24 per cent. In 21 towns the top step will be 9½ cents a kilowatt-hour for 30 kw.-hr., then 7 cents for the next 60 kw.-hr. and 3 cents for excess consumption. In four larger places the rates will be 8½, 7, 4 and 3 cents; in Fort Scott, the largest place served, 7½, 6½, 4 and 3 cents.

The Empire District Electric Company filed a revised schedule for Baxter Springs—$1 for 5 kw.-hr., 5 cents a kilowatt-hour for the next 50, 3 cents for the next 150 kw.-hr., then 2½ cents.

Claiming that it stands to lose at least $3,000 during the month of July as a result of a lowered municipal electric power rate, Rice Lake, Wis., will seek a rate revision from the Public Service Commission. It must either do this or obtain a reduction in the wholesale price of power, which it purchases from the Northern States Power Company for 2.76 cents per kilowatt-hour. In past years the city has profited to the amount of $10,000 per year, but the commission ordered a rate which reduced the city's profits to $1,000 a year.

400,000 SEE LA FIESTA'S LIGHTED PAGEANT

—Wide World Photos

While, two weeks ago, 110,000 persons crowded the Olympic Stadium at Los Angeles, where Hollywood gave a glittering spectacle under electric light, 300,000 others jammed the streets to see the floats.

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Public Ownership Issue in Three Washington Cities

BY UNANIMOUS VOTE THE City Council of Puyallup, Wash., has determined to take over on November 1 the Puget Sound Power & Light Company's holdings in that city, issuing $250,000 in bonds for that purpose. This action ended a long fight, the company having contended in the courts that its holdings are worth $400,000, but losing the case. The Puyallup voters at an election in November, 1928, by a vote of seven to one, decided to acquire their own power plant.

At a special election on November 3 Pullman, Wash., will pass upon the proposal to acquire by purchase or condemnation the power facilities of the Washington Water Power Company there, by issuance of bonds for $150,000. Studies of municipal ownership are also being made by committees at Clarkston, Wash., and Coeur d'Alene, Idaho, in both of which towns the Washington Water Power Company owns and operates the electric service and water systems.

A petition signed by more than 200 industrial power users urging that favorable action be taken by the Tacoma City Council on the application of the Puget Sound Power & Light Company for a new franchise in that city has been presented to the Council. It is held that Tacoma would lose far more from the withdrawal of the utility company than the municipal plant could possibly gain.

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Scattered Happenings in the Electrical Sphere

UNITED STATES

Insulation Meeting for Harvard

The fourth annual meeting and conference of the committee on electrical insulation of the division of engineering and industrial research of the National Research Council will be held at Harvard University, Cambridge, Mass., on November 13 and 14. There will be three technical sessions with papers on the physics and chemistry of dielectrics and on recent progress in engineering research in the field of dielectrics as applied to the insulation of electric circuits. A dinner on Friday evening will be followed by a lecture dealing with recent advances in dielectric theory. Dr. J. B. Whitehead of Johns Hopkins University is chairman of the committee.

Federal Power Board's Questionnaire

Dr. W. M. W. Splawn reports to the Federal Power Commission that thus far approximately 25 per cent of the utility companies to which the commis-

sion sent its questionnaire have answered in whole or in part. Some of the larger holding companies have requested brief extensions of time for filing parts of the returns.

Roosevelt Appoints More Investigators

Governor Roosevelt has appointed Myer Jacobstein of Rochester and Karl R. Miner of Yonkers as members of "the commission to make a general survey of utility companies of states adjoining the State of New York engaged in interstate transmission of power and to negotiate and agree upon the terms of a treaty or compact between the states and the government of the United States, for submission to the legislatures of such states and to the federal government for approval, such treaty or compact to cover comprehensively all matters relating to the effective regulation and control of interstate transmission of power between such states." The Governor's appointees serve in conjunction with two senators and two members of Assembly.

Rate Reductions Sought in Indianapolis

Public agitation for a reduction in the rates of the Indianapolis Power & Light Company has brought forth requests for investigation from civic clubs and others, and the Real Estate Board of the city may make an investigation of its own. The dissatisfaction is fostered by the Indianapolis *Times*, which maintains that local rates are based on a war-time valuation and that the operating company pays excessive fees to the holding company—the Utilities Power & Light Corporation of Chicago.

San Joaquin Rates Before Commission

Permanent rates to be charged by the San Joaquin Light & Power Corporation and its subsidiary, the Midland Counties Public Service Corporation, on all classes of electrical energy were again taken up in Fresno, Calif., last week by the California Railroad Commission. The hearing had been adjourned from May 26. The city attorney of Fresno moved for a separate hearing for that city on the ground that it had been the "victim of unreasonable and discriminatory power rates." He explained that he was referring to the *ad interim* rate schedule, which, he said, discriminated in favor of the agricultural interests of the territory on sympathetic grounds. The hearing was adjourned to November 17.

Ford Adds 110,000-Kw. Unit

The 110,000-kw. vertical compound turbo-generator built by the General Electric Company for the River Rouge plant of the Ford Motor Company, which embodies novel features of design, has gone into operation. It represents an outlay of approximately $8,000,000 and supplements four other units, each of 30,000 kw. rating.

Rochester Company Not to Merge

Permission to withdraw its petition for leave to merge with the New York State Electric and Gas Corporation has been granted to the Rochester Gas & Electric Corporation by the New York Public Service Commission.

New York Rate Case Again Hangs Fire

Another week's postponement followed another plea of unreadiness to proceed when the complaint against New York Edison rates brought by the Washington Heights Taxpayers' Association came up again on September 18 before the New York Public Service Commission. Chairman Maltbie indicated that if there was a third failure to go ahead on the part of this association, he would have to dismiss the proceedings.

Coming Meetings

International Association of Electrical Inspectors—Southwestern Section, Sacramento, Calif., Sept. 28-30. C. W. Mitchell, 914 Merchants' Exchange Bldg., San Francisco. Northwestern Section, Salem, Ore., Oct. 5-7. F. D. Weber, 414 Lumbermen's Bldg., Portland, Ore.

New England Division, N.E.L.A.—Poland Springs House, South Poland, Me., Sept. 28-30. Miss O. A. Bursiel, 20 Providence St., Boston.

American Association of Engineers—Huntington, W. Va., Sept. 28-30. M. E. McIver, Willoughby Tower, Chicago.

American Electric Railway Association—Atlantic City, Sept. 28-Oct. 2. Guy C. Hecker, 292 Madison Ave., New York.

Great Lakes Division, N.E.L.A.—French Lick Springs Hotel, French Lick, Ind., Oct. 1-3. T. C. Polk, 20 N. Wacker Drive, Chicago.

Association of Electragists International—Hot Springs, Ark., Oct. 5-8. L. W. Davis, 420 Lexington Ave., New York.

National Electric Light Association—Engineering National Section committee meetings, Starrett's Netherland Plaza, Cincinnati, Oct. 5-9. A. J. Marshall, 420 Lexington Ave., New York.

National Safety Congress—Chicago, Oct. 12-16. W. H. Cameron, 20 N. Wacker Drive, Chicago.

Illuminating Engineering Society—William Penn Hotel, Pittsburgh, Oct. 13-16. E. H. Hobbie, 29 W. 39th St., New York.

National Association of Railroad and Utilities Commissioners—Jefferson Hotel, Richmond, Va., Oct. 20-23. J. B. Walker, 270 Madison Ave., New York.

Wisconsin Utilities Association—Commercial Section, Oct. 22-23, Hotel Loraine, Madison; Electric Section, Hotel Pfisterer, Milwaukee, Nov. 12-13. J. N. Cadby, 135 W. Wells St., Milwaukee.

American Institute of Electrical Engineers—District meeting, Kansas City, Mo., Oct. 22-24. F. L. Hutchinson, 33 W. 39th St., New York.

National Electrical Wholesalers' Association—Starrett's Netherland Plaza, Cincinnati, Nov. 9-13. E. Donald Tolles, 165 Broadway, New York.

North Central Electric Association—Accounting Section, St. Paul Hotel, St. Paul, Nov. 13 and 14. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

International Conference on Bituminous Coal—Pittsburgh, Nov. 16-21. T. R. Alexander, Carnegie Institute of Technology, Pittsburgh.

Fish Hatchery at Bagnell Dam

A fish hatchery to stock the Lake of the Ozarks, formed by water backed up by the company's hydro-electric dam on the Osage River near Bagnell, Mo., will be built by the Union Electric Light & Power Company of St. Louis, under a new law permitting the owners and operators of a power dam to substitute a fish hatchery for the fish ladder heretofore required for such dams. The height of the dam at Bagnell makes the construction of a fish ladder impracticable. The hatchery will be operated under the supervision of the Missouri State Game and Fish Department and will cost from $40,000 to $50,000.

A.E.R.A. "Golden" Anniversary

Next week the American Electric Railway Association will hold its fiftieth annual convention at Atlantic City. The Power Division of the Engineering Association will have sessions on Tuesday and Wednesday, with reports on mercury power rectifiers, power contracts, lightning protection, 600-volt railway substation spacing and other topics. At the Advisory Council open session on Tuesday evening Julius H. Barnes will deliver an address.

CANADA

Beauharnois' Quebec Charter Attacked

If the contentions of R. A. Reid, a Toronto lawyer, prove well based, the charter from the Province of Quebec under which the Beauharnois Light, Heat & Power Company has operated, and which Premier Bennett of the Domininion government held to be inviolable, is, on the contrary, invalid, leaving the situation in the hands of the Dominion government, which can reorganize the whole power project in any way it likes and nullify all stock and bond issues which do not represent cash investments. Mr. Reid bases his argument on the simple fact that the charter authorizes the company to operate within a radius of 40 miles of the town of Beauharnois, which would bring it into the province of Ontario and carry it into the United States, territories obviously outside the jurisdiction of the Quebec authorities.

ABROAD

London to Be Permanently Floodlighted

Formation of the British Illuminated Nights Association, with the object of brightening up London and the cities of England, is announced as an outcome of the International Illumination Congress recently held in Britain. It is proposed to devote one night a week to floodlighting and other forms of illumination. Cost is put at $50,000 a year. Electrical organizations are keenly interested in the proposal, and the co-operation of merchants and others will be sought to install organized flood lighting.

By-product electricity for Connecticut Valley

Water falling 450 ft. from the 22,000,000,000-gal. domestic supply reservoir of Springfield, Mass., at Cobble Mountain is to develop electrical energy for the Turners Falls Power & Electric Company's system as permitted by the city's needs and surplus storage available. A 23,000-kw. generating station has been built by the power company and leased from the city for 30 years. The project includes an earth dam 247 ft. high, a pressure tunnel and a surge tank 207 ft. high and 25 ft. in diameter.

EDITORIALS

L.W.W.MORROW
Editor

Utility tax reforms merit active sponsorship

THE unfortunate plight of New York utility companies, four times taxed unreasonably, as pointed out by the former State Tax Commissioner at the recent convention of the Empire State Gas and Electric Association, is not an isolated or specially unusual one. Tax burdens fall thick and fast in almost every commonwealth. As Mark Graves, now Director of the Budget from New York State, further pointed out: "A better and more equitable distribution of the tax burden cannot be accomplished without the co-operation and assistance of the various groups and classes of taxpayers. I would like to see associations present some really constructive proposals."

Mr. Graves took his own advice. He offered some suggestions of his own. In New York there are for utility companies a general property tax on real property, a general property tax on the privilege or right to occupy streets, highways or public places; a tax of one-half of one per cent on gross earnings or gross receipts from all sources, and a tax on any excess from which dividends of more than four per cent are paid. Mr. Graves urged assessment of the first tax on a state basis instead of by local boards, abolition of the second as "unadministrable," and consolidation or unification of the third and fourth to avoid duplication.

There is little prospect of taxes ceasing to rise in this country for some years to come. It would be well indeed so to prepare that the levies will not duplicate one another in effect and purpose. The problem of intelligent and equable taxation is, as Mr. Graves pointed out, to raise necessary sums with the least harm and detriment to social, business, industrial and commercial conditions as well as to all individuals concerned. Where a co-operative attitude, as in New York, is evidenced by state authorities every effort ought to be made to meet it. Where such co-operation lags, intelligent, honest planning may help to clarify the situation and avoid unwieldy and duplicate burdens as levies further grow.

Ritchie decries public ownership

IT IS refreshing to find a presidential candidate talking common sense about the light and power industry. Last week in a notable address before the American Bar Association the downright and uncompromising Governor Ritchie of Maryland applied his consistent plea for state rights and non-governmental interference with business to the power issue. "No good can come from trying to frame political issues about it or from treating it from any other than an economic standpoint," the Governor asserted. "Power development is still in the making, and let us avoid too many noble experiments that may check or chill it."

Admitting that "the whole range of public utility operations is admittedly one calling for public scrutiny and supervision," the Governor said that "the national policy must not be government ownership in any form." It is his opinion that any deficiencies in the present system can be removed by an improvement in state regulation if the states so desire. Under a system of national ownership "we would become economic slaves and the political slaves as well of the federal government."

These statements of Mr. Ritchie are in entire agreement with his political creed and indicate

his aversion to indirection or political flirtations to improve his position as a potential presidential candidate. Citing facts to prove his case, he stands firmly for the "irreducible minimum of legislative interference in every field of human effort, including the public utilities." We admire his courage and common sense and agree with his conclusions.

Buying equipment on an engineering basis

FAIR prices for electrical equipment must be had in the long run if manufacturers are to serve the industry market on sound economic lines. It is elementary to assert that such prices must cover all costs of development, production and sales plus overheads and a reasonable profit if the making of electrical machinery and supplies is to prosper. Unless the manufacturing branch of the industry is economically successful, buyers must lose far more than they can ever gain by temporary slashes in bids to secure business during recessions.

Under pressure to save substantial sums in purchasing, some buyers of electrical equipment appear to have adopted a policy of trying to force down bids by the revision of quotations in the light of stiff competition to levels on which it is difficult, if not impossible, to sell at even a low profit. In fact, it is intimated that some manufacturing organizations are accepting contracts here and there at an actual loss in order to keep plants at work wholly or in part. It is natural that purchasing agents should desire to make as good a showing as possible to their superiors in times like these; but it is hard to believe that the executives of power companies, or, indeed, of the higher-grade manufacturing firms, desire to buy apparatus on terms which reputable manufacturers consider as ruinous for the long pull. Such terms include unprofitable bids offered against loss of business with old and established customers, needlessly early delivery dates (which could have been greatly extended with proper system planning) with their imperative demand for overtime in the manufacturing organization, meeting offers of competitors which make better promises than fulfillments, sacrifice of quality production under time pressure, call for hurried designing, short-cut inspections, undue express shipments and other burdens.

It may be no responsibility of the purchaser if a manufacturer consents to sell at sub-cost prices. The apparatus and supply buyer may declare that no manufacturer need accept below-cost negotiations. The buyer is not in a position to know manufacturing over-all costs, say others. These points do not tell the whole story, however, for years of intimate relations between buyers and sellers reveal much that is not outwardly apparent as to economic conditions on each side of the table. The power industry with its relative stability of earnings is in an exceptional position to buy on an engineering value basis, demonstrating that in the long run this is the soundest policy. In many cases industrial buyers will turn away from price to quality buying on due appreciation of such values. Business done at a loss benefits no one in the long run, and attempts to beat down fair prices to bargain-counter levels should not be countenanced by industry executives.

An anticipatory system of generator protection

BASED upon the admirable notions that a stitch in time saves nine and that it is unnecessary to wait for the house to catch fire before trying to do something about it, European engineers have produced a new form of generator protection. This system aims to detect all classes of faults in their incipient stages. Insulation fault conditions are invariably preceded by progressive disintegration of dielectric materials, and this protective scheme has therefore been based upon the influence of the preliminary release of products of decomposed insulation during incipient stages of failure.

A detector, consisting essentially of a cylindrical tube divided lengthwise in two compartments, one used as a standard of comparison and the other for the passage of small diverted quantities of discharged cooling air, contains an incandescent lamp whose radiant heat, equally reflected through both compartments, falls on two groups of nickel-strip detectors which vary in ohmic value with their temperature. These detector groups are each connected with resistances of constantan to form a Wheatstone bridge. By means of a gal-

vanometer-type relay any voltage difference can be detected at the two points of normally equal potential. Increased insulation decomposition content of the exhaust air reduces the heat radiation through the second compartment, thus operating the device.

So successful and satisfactory have experimental installations of this Buchholz system proved that several European manufacturers have taken up production licenses. Sensitivity and tripping time depend on the degree of the seriousness of the disturbance involved. In none of the tests made, involving short circuits between turns, short circuits between coils and direct grounds, was there reported any damage with the exception of that to the faulty coil itself.

So thoroughly anticipatory is this scheme, precluding extensive damages and repairs and thereby reducing shut-down time and costs, that it deserves a thorough investigation of possible application to practices in this country. Reported first costs are low, and the design is relatively uncomplicated.

Failure to test grounds inconsistent with investment

PAINSTAKING attention is customarily given to the selection of the best arrester and the best type of ground rod, and then the lineman usually drives the rod down alongside the pole without attempting to ascertain the ground resistance. Furthermore, after the ground is installed, it is seldom inspected for deterioration or disconnection. Still, it is often found that the ground resistance alongside a newly set pole is as high as 200 ohms because of rocks, voids and so on, whereas only two feet away the resistance may be 2 ohms. In some cases ground resistance which tested 2 ohms when it was first installed has been found to be as high as 200 ohms a month later because of changes in soil conditions.

Until recently the testing of ground resistance was an elaborate procedure requiring laboratory instruments and tiresome calculations. But now there are available quite a number of simple standard portable instruments by means of which any lineman can test a ground by a direct-reading method in a few moments. Therefore all utilities which expect to reap any benefits from their investments in lightning arresters and ground wires will find value in having their linemen test all grounds regularly at definite intervals during their regular rounds of inspection. In addition, if the men are required to report the results of these tests, any conditions threatening danger to the lines can speedily be rectified.

Code shows tendency to moderate restrictions

CODES and code preparation have so frequently been criticised that it is a pleasure to be able to say something commendatory regarding the conditions attending the issuance of the 1931 National Electrical Code, just approved by the American Standards Association. Much to the satisfaction of users, installers and manufacturers of electrical equipment, the code does not embody any added restrictions. Most of the changes have been made to modify requirements or clarify understanding. The analysis of the code compiled by Arthur L. Abbott and available from the National Electrical Manufacturers' Association should be a big aid in quickly assimilating the significance of the changes.

But most encouraging are the examples of tendencies to allow applications of new ideas or extend the permissible use of equipment formerly restricted. For instance, the new code permits the utility meter to be placed ahead of the service switch and service fuses under certain conditions, and when this practice is followed allows, with various safeguards, the use of branch circuit breakers in place of the main switch. Then, too, there is a broader recognition of metallic tubing as a raceway.

In the section on motor circuits and protection greater recognition is shown of the diversity of demand where more than one motor is connected to a circuit, and provisions for protection of conductors and motors have been modified. The requirements on grounding have been greatly clarified by correlation and cross-references.

Coupled with the greater leniency shown by local inspectors in allowing new forms of wiring to be installed where such forms can be kept under observation to determine their relative hazard, the regulation of wiring practices is headed in a direction which is much more encouraging than has previously been the case.

Governor Takes Firm Stand Against Government Ownership

GOVERNMENT ownership of the power industry would make us political slaves of the federal government. State regulation suitably strengthened where it is lacking will solve all the problems better than any form of state ownership. These were two thoughts that dominated an address presented before the public utilities law section of the American Bar Association September 15 by Governor Albert C. Ritchie of Maryland.

"Justly or unjustly," he said, "the public utilities seem to be more or less under suspicion. Perhaps this is due in part at least to the fact that through natural economic evolution the utilities are generally monopolies, and by tradition monopolies are odious. It is hard for some people to believe that there can ever be a good monopoly, or indeed that any of them ever try to be good."

Referring to the well-known proposals of Senators Norris and Couzens and of Governor Pinchot, he declared:

"These proposals, advanced with the almost passionate earnestness of crusaders, show an amazing loss of confidence in individual initiative and responsibility and in the power and effectiveness of state government.

"There may be in this vast country power resources so special in their nature, governed by conditions so exceptional, that the public welfare may require special and exceptional treatment. Muscle Shoals—a war product and a war liability—is one. Indeed, that is so special and so exceptional that the combined wisdom of many sessions of Congress advised by two Presidents has not been able to work it out. Boulder Dam may have been another such instance, but the federal government has already decided its policy there and it is now being carried into effect. Cases like these, however, are very rare. They cannot be permitted to determine the national policy on the subject.

"The national policy, it seems to me, must not be government ownership. The capitalistic system has its defects, of course—periods of forced unemployment is perhaps the worst—but it has centuries of evolutionary growth back of it, and under it we have come to lead the nations of the world in every form of progress. I do not believe in crippling it.

"Our political ideal always has been to encourage private enterprise, to bestow upon it the earned rewards of brain and labor, and to keep open the door of opportunity. Here, I believe, is the key to our material success. Here is a political ideal worth guarding and worth fighting for.

"In spite of the inequalities of wealth and fortune, innumerable forces of amelioration, of socialization and of equalization are at work, all along lines which are at once sound and germane to our institutional growth.

Governor Albert C. Ritchie

"If government ownership is so desirable for public utilities, one might ask why not apply it to every business in which the public has an economic interest—and what business is there in which it has not—from foods, fuels, clothing, houses, amusements and luxuries on down the line? If it is economically advisable in one case, why is it not equally so in the others?

Limitation on powers of government

"The American idea of governmental sovereignty is to define and limit governmental powers. It leaves the individual as free as possible to work out his own destiny. It protects him in his rights and his property. It does not permit the government, in the name of the people, to absorb business or undertake enterprises beyond the legitimate needs of public administration.

"Our detours from this principle are already too many. There should be no more. It is still true, as Buckle concluded after his long study of the history of civilization, that the chief province of government is to maintain order, to prevent the strong from oppressing the weak, to see to the public health, education and other governmental functions, and that the history of economic legislation is largely a history of mistakes."

Sharp issue was taken with Governor Pinchot's state-

ment that every home is being drained to make enormous profits for utilities. Governor Ritchie said:

"It would be hard to beat these statements for extravagance, and I have never heard of any bill of particulars to support them. In fact, the only specific assertion in them, namely, that the utility companies increased their profits by more than $44,000,000 in 1930, has since been shown to be erroneous, in that this increase was not in profits but in gross earnings. And how can it be true that 'every home is being drained,' when the statistics of the National Electric Light Association show that electric rates have gone down 31 per cent since 1913, while the cost of living has gone up 57 per cent? The truth is that the electric bill is generally the smallest item in the family budget. There is no clamor for less rates. The clamor is for more service."

Referring to the instance most frequently cited for the success of public ownership, Governor Ritchie stated:

"I venture the assertion that in Ontario Sir Adam Beck built up a great political machine on an economically unsound project, which sells current to domestic consumers at less than fixed charges and the cost of production and distribution, and that the industrial users and the taxpayers pay the losses.

"I would like to see all government-owned projects subjected to a simple test. Regard them as if they had to stand on their own feet, as if they had to keep their books as privately owned enterprises of like character must keep theirs, and pay taxes on the same basis. Regard them as if the national, state or municipal credit was not behind them, and as if their charges and losses could not be buried in general governmental accounts. Do that, and I venture to say that nearly all will show operating deficits."

Senator Norris' statement that "unless we retain our natural resources we will be the economic slaves of the private power industry," was met by the rejoinder:

"My fear is that if this plan were adopted we would be the economic slaves and the political slaves as well of the federal government.

"We have feared economic serfdom before, and public ownership has been advanced as the remedy. Today it is the power industry. Not so many years ago it was the railroads. Well, the World War came and the government as a war measure took over the railroads. It turned them back again disorganized and demoralized, with tracks, equipment and rolling stock run down.

"Government ownership of the power industry would make us political slaves of the federal government. By that I mean that it would result in a political machine staggering in its magnitude. That is what has happened in Ontario. It would just as surely happen in this country.

"In 1930 there were 275,000 people employed in the electric light and power business—234,000 men and 41,000 women. The salaries and wages paid them, based on the payments actually made to those employed in 1927 as shown in the United States Census report of that year, was $435,000,000. It staggers one to think of this vast organization as a new arm of the federal government, with its operating efficiency diminishing under the red tape and routine of governmental administration, and with its potency for political and partisan use. Nor are these statistics complete, because they cover operating enterprises only. It is estimated that the holding companies employ 25,000 additional persons.

Taxes paid by industry would be lost

"The taxes paid by the power industry would, of course, be lost in case of government ownership. In 1930 these taxes amounted to $200,000,000, of which over 32 per cent went to the federal government, from 10 to 15 per cent to the state governments, and the remainder to the various cities and counties. These taxes amount to practically 10 per cent of the gross revenues of the power companies. If the industry stops paying this enormous sum toward the support of government, as it would do if government took it over, then the already overburdened taxpayers of the country would have to dig down in their pockets and make it up. Thus a movement whose alleged purpose is to help the public would tax the public $200,000,000."

Governor Ritchie did not deny to the people of any state the right to protect and develop their power resources in whatever way may seem to them best adapted to that end. But he did say:

"I do not believe there are many instances in which state regulation will not amply suffice, rather than any form of state ownership.

"I know this is true about my own state of Maryland. We both import and export power, but we have no interstate power problem. The contracts under which it is sold are subject to the supervision of the Maryland Public Service Commission. If the price were excessive the commission would disallow the excess in fixing rates.

"We export between 55 and 60 per cent of the power we produce. The rate at which it is sold in Pennsylvania is completely under the control of the Pennsylvania commission.

Authority of states to regulate service

"What is done in Maryland and Pennsylvania can be done elsewhere, and I believe that by and large the states have ample power to regulate and prescribe fair rates and adequate service and to enforce them."

Answering Governor Pinchot's statement that the majority of states have no power to regulate power transferred between states except by clumsy compacts, Governor Ritchie said:

"Aside from the fact that the amount of current passing in interstate commerce is only about 13 per cent of the total kilowatt-hours consumed—and this fact is important—I submit with very great respect that the Governor is mistaken in his proposition.

"The distribution of power in any state is a local matter in that state. It is an operative function. The power has lost whatever interstate character it had, and the company which distributes it is subject to the state law as to both rates and service. The state commission, under a proper state law, has or can demand all the sources of information it needs to determine fair rates and adequate service and to compel both. If the distributing company purchases its power from an importing company the state commission need not regard the terms of the contract, if they are excessive. The commission can

disallow the excess in fixing rates, and the distributing company when it makes the contract knows that the commission has that right.

"The states have the power. All they have to do is exercise it. They can have just as strict a measure of control over rates and service as their people want to have. If any of them are content with weak commissions or with weak laws, that is their own misfortune, and most certainly it is no reason for saddling the burdens of public ownership on the people.

"If our system of state regulation has not everywhere accomplished all that it is capable of, then it should be built up and strengthened where it is lacking, and through the Anglo-Saxon processes of experiment and trial and error we are daily doing this. Far more is to be expected from strong state commissions (with some degree of that higher interstate concord and co-operation and uniformity which I think I see coming in this and other lines), than will ever be realized for either the consumer or the utility from too much concentration in government, state or federal. That tendency has gone much too far for safety as it is.

"I am for the irreducible minimum of legislative interference in every field of human effort, including the public utilities. In this era of triumphant industrialism, all of us recognize that the possibilities and actualities of special privileges, of injustice and of exploitation are so great that some adequate system of checks and balances must be supplied. But why look only to government to supply it?

"Government interference in human affairs means an excess of power. It means bureaucratic centralization, and sterilization and undue impairment of individual rights and liberties. In business it becomes more of an incubus than a help. It can hector and harass so much easier than it can guide and guard. It can so readily do more harm than good, even where only good is intended.

"Should we not, then, try to make public opinion operate upon industry direct? Indeed, may we not expect industry itself, for its own security and in the hope of its own salvation, if for no other reasons, to work out self-governing ways of eliminating any ills and injustices which not only the public but enlightened business itself should not tolerate?

"Personally, I have faith in this expectation. The logic of events favors its realization. Industry must be blind indeed if it does not realize that it must put its own house in order, and there are many evidences that it is trying to do so. This depression has one benefit to its credit. It has awakened business to the necessity of a more enlightened and constructive statesmanship of its own.

"Development of power has added immeasurably to the wealth of the nation, and it is not old wealth taken from others by the processes of trade, but new wealth wrung from the treasure house of nature. This involves a high order of initiative and enterprise. It calls for risks for which capital has the right to its just return.

"Above all, we ought not to regard this utility and power question as a legitimate political issue in any partisan sense. The subject is one for the best brains of the land, regardless of party. No good can come from trying to frame political issues about it or from treating it from any other than an economic standpoint.

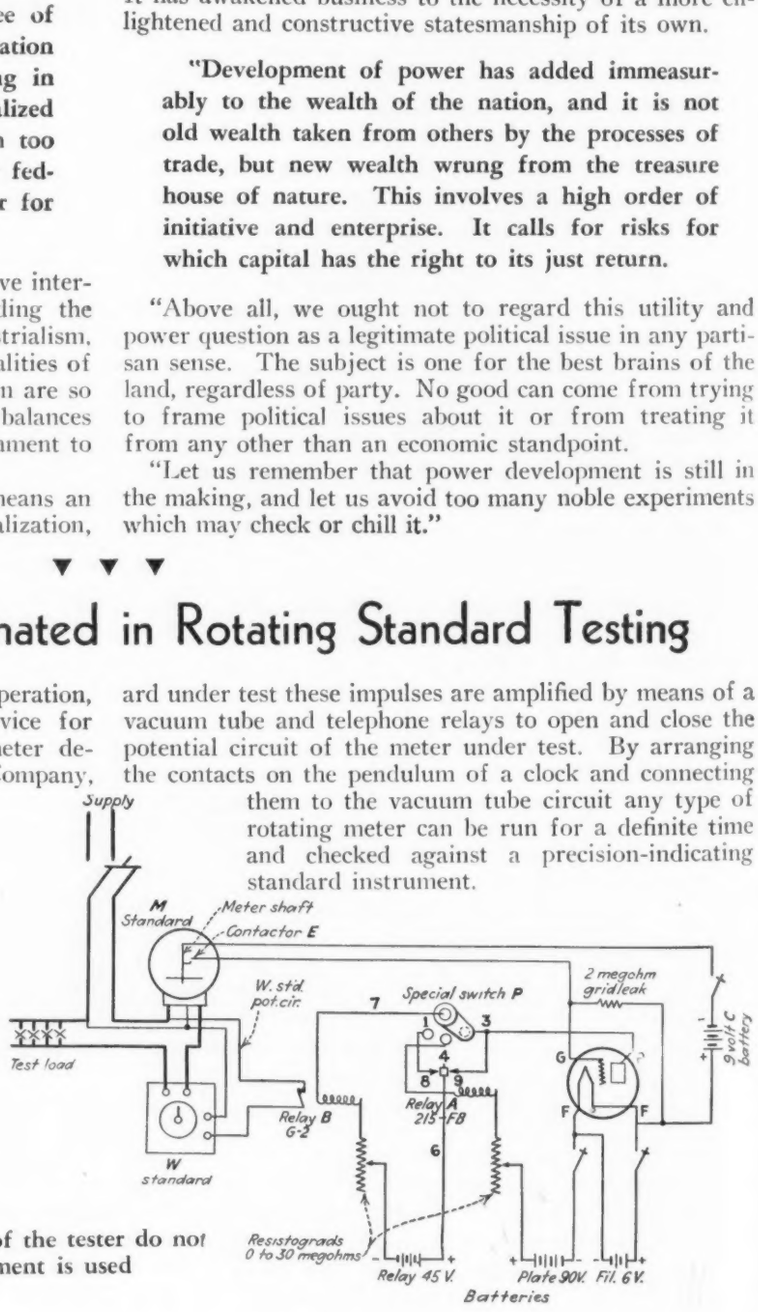
"Let us remember that power development is still in the making, and let us avoid too many noble experiments which may check or chill it."

▼ ▼ ▼

Manual Switching Eliminated in Rotating Standard Testing

Great sensitivity, combined with the stable operation, is claimed for a vacuum tube and switch device for timing rotating standards, developed in the meter department of the Puget Sound Power & Light Company, according to a recent report of the N.E.L.A. meter committee on new developments in electrical measuring and auxiliary testing devices. The scheme, as shown by the accompanying connection diagram, was developed to eliminate the use of stop watches and manually operated switches in checking testers, rotating standards against master rotating standards in the laboratory.

The master rotating standard is equipped with very light contact points arranged on the shaft and frame of the meter to make one contact per revolution. To utilize the contact impulses for starting and stopping the standard under test these impulses are amplified by means of a vacuum tube and telephone relays to open and close the potential circuit of the meter under test. By arranging the contacts on the pendulum of a clock and connecting them to the vacuum tube circuit any type of rotating meter can be run for a definite time and checked against a precision-indicating standard instrument.



Nervous and muscular co-ordination of the tester do not affect the test when this equipment is used

Tubular Copper Bus Simplified Service Vault

Use of tubular copper bus greatly simplified construction in building a basement vault to supply a large department store in Portland, Ore. A lighting load of 775 kw. and a power load of 1,500 kw. is supplied from four 450-kva., 11-kv./125-216-volt vault-type transformers by the Northwestern Electric Company. Secondary leads connect to four 1,600-amp. open-type network protectors and thence to overhead tubular copper buses as shown in the accompanying illustration.

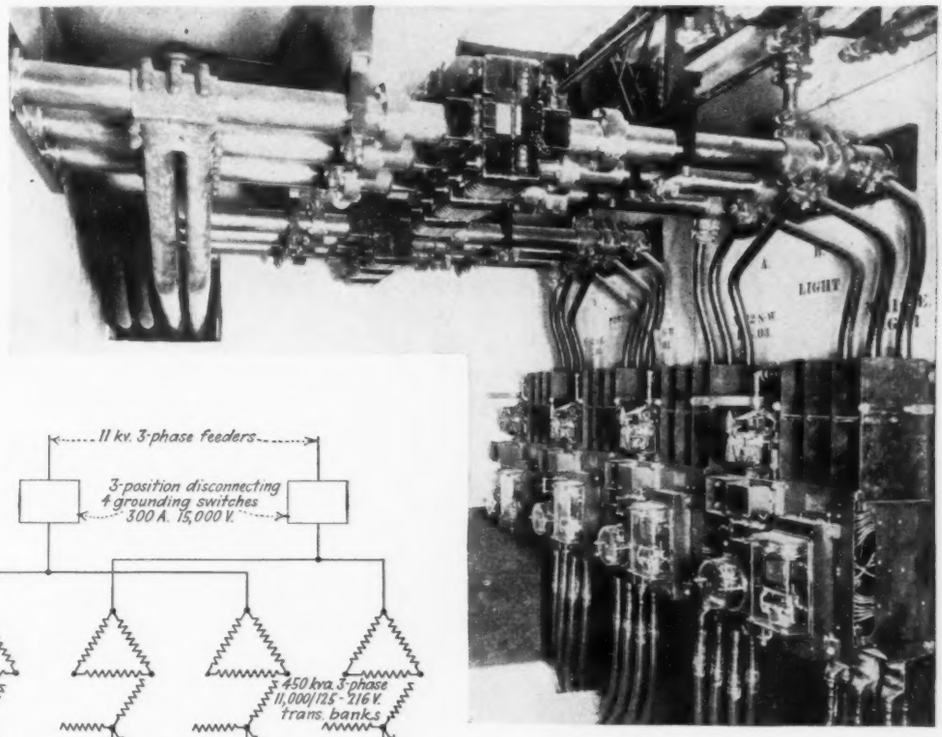
The lighting bus is 3½ in. in external diameter, of extra-heavy hard-drawn copper, having a cross-sectional area of 4,723,000 circ.mil. The power bus is of the same diameter, but is of double-extra-heavy cross-section, having an area of 8,558,000 circ.mil. A cross-tie bus having 5 per cent reactance in each leg connects the two and also is the point of tie to the street network.

Current transformers for metering the light and power services are slipped over the tubular bus, with the transformer sections arranged for replacement in case of transformer failure. Owing to the space available being cramped, it was impossible to install the standard split-clamp connectors in these short sections, copper flanges being used instead. All flanges on both buses, with the exception of one end of the short section, were assembled to the copper tubing by shrinking and sweating. The one flange not so assembled was inserted into the tubing with snug sweat fit, which provided a method for removing transformers from the short sections in case of failure. The contact surfaces of all flanges were glass-lapped to insure best possible contact. Expansion of the buses is provided for by sliding supports at each end of the bus.

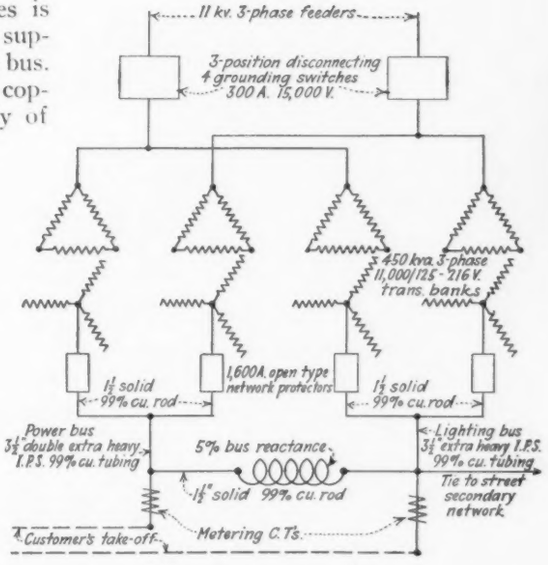
Flanges are of pure copper, with a conductivity of 82 per cent. Considerable difficulty was encountered in obtaining this type of copper casting, and it was accomplished only after a great deal of experiment in foundry methods. The final perfect result was obtained by using Federal Metal Industry formula No. 19. The resulting castings contain 99 per cent copper and 1 per cent alloy. The 1 per cent alloy consists of 88 per cent copper, 7 per cent silicon and 5 per cent calcium.

Perfect castings were obtained only by placing in the cold retort the copper, certain amounts of ground charcoal and ground glass and bringing the entire contents to the proper temperature as a mass. Considerable care had to be exercised when taking copper from the retort for pouring to see that the charcoal and glass surface was not disturbed. Otherwise oxidation would have taken place in the molten metal remaining in the retort. Castings machined before this technique was developed showed a very spongy structure.

Metering for the entire installation was greatly simplified by using a totalizing demand meter of a new type. This is the Westinghouse "RA" impulse-operated totalizer, giving combined demand of the separately metered light and power on one chart as well as the total kilowatt-hours. It is planned also to add the relays and contacts necessary to record on this totalizing meter the aggregate of the direct-current load in the same building.



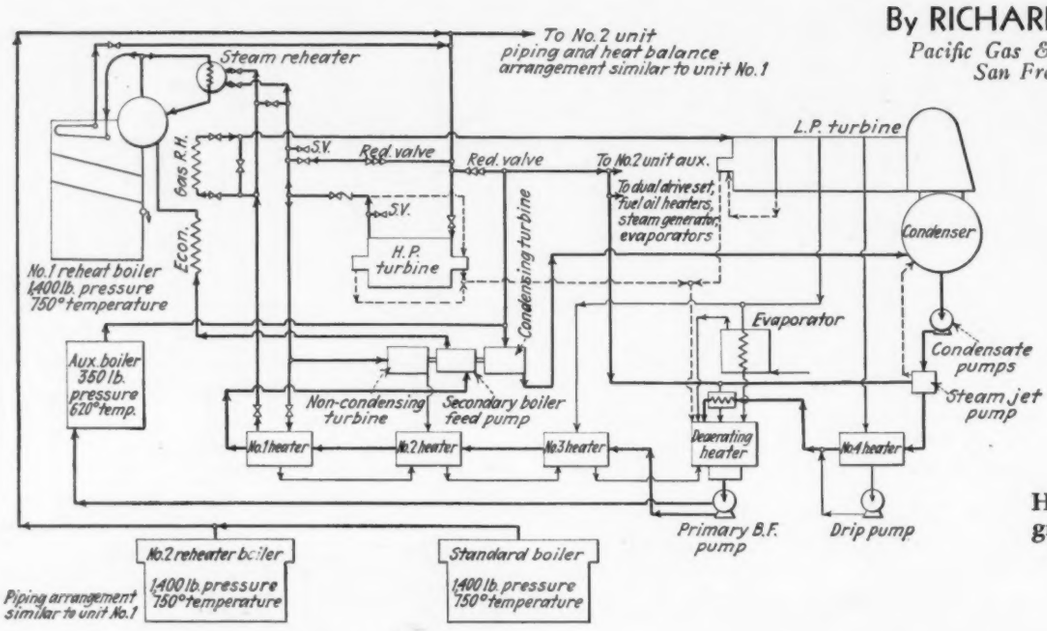
Simplicity and neatness characterize this vault for supplying 2,275-kw. lighting and power load


11 kv. 3-phase feeders
3-position disconnecting & grounding switches 300 A. 15,000 V.
450 kva. 3-phase 11,000/125-216 V. trans. banks
1½ solid 99% cu. rod
1,600 A. open type network protectors
1½ solid 99% cu. rod
Power bus 3½" double extra heavy I.P.S. 99% cu. tubing
5% bus reactance
Lighting bus 3½" extra heavy I.P.S. 99% cu. tubing
1½" solid 99% cu. rod
Tie to street secondary network
Customer's take-off
Metering C.Ts.

Connections used in taking large customer's service from an a.c. network

Experience at Station A with 1,250-Lb. Steam Pressure

By RICHARD C. POWELL
Pacific Gas & Electric Company, San Francisco, Calif.



Heat-balance diagram for 1,250-lb. station A plant

EXPERIENCE in starting up a 1,250-lb. steam plant, results obtained as to fuel consumption and some general conclusions regarding use of high pressure in the San Francisco station A steam plant on the Pacific Gas & Electric Company should prove of interest to other operators. The first of two 50,000-kw. vertical compound units for operation at 1,250-lb. steam pressure went into service Feb. 7, 1931, together with one of the reheat boilers. The standard boiler was put on the line April 14, and the second turbine and reheater boiler units were put into service on June 20. At the time of this writing the first unit has been in operation almost five months, a sufficient time to form a fair opinion of the general performance of high pressure. A short description of the installation will assist the reader to a more complete understanding.

Station A was first put into operation just 30 years ago with engine-driven units operating on 200-lb. boiler pressure. During the period from 1911 to 1919 all but two of the engine units were removed and four turbine units (three vertical and one horizontal) were installed, using the original boiler pressure with 100 deg. F. superheat. Two engine units, two vertical turbines and about half of the 30 boilers were removed for the installation of the two 50,000-kw. vertical compound turbines and three boilers. The boilers each have an output rating of 500,000 lb. per hour with 1,350-lb. drum pressure, 750 deg. F. total temperature, and two of the boiler units are equipped with reheaters to reheat to 750 deg. F. The accompanying heat-balance diagram shows also the boiler and high-pressure piping arrangement, together with 325-lb. auxiliary steam supply.

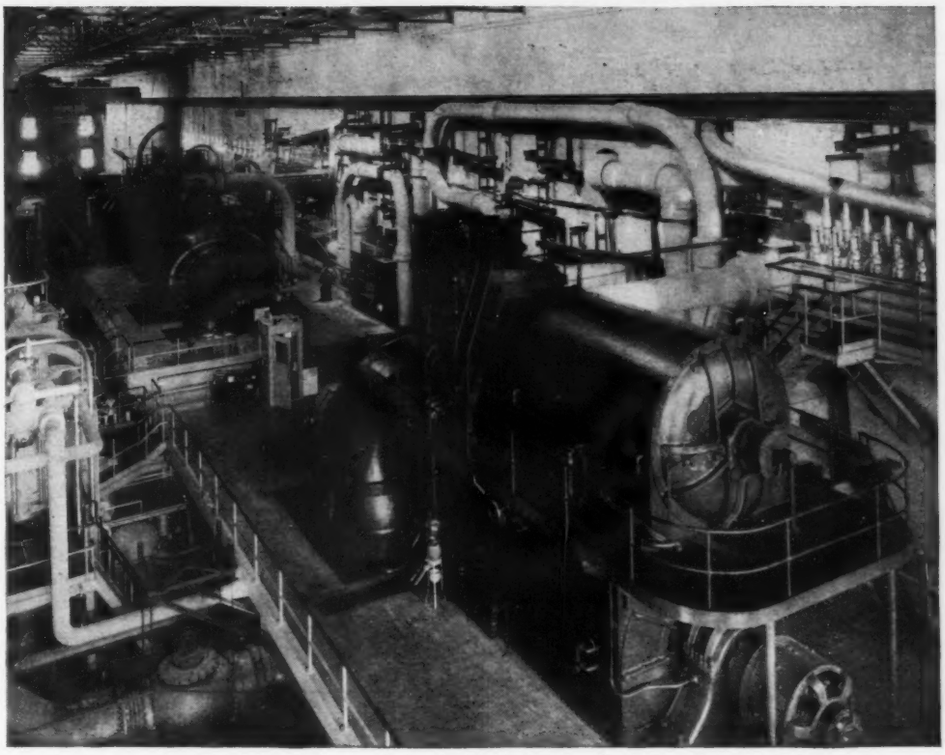
Fundamentally the design is quite similar to that of the Deepwater and Gilbert stations. The turbines are the same, but with somewhat more overload capacity, and are vertical instead of cross-compound. The boilers are larger, and all the reheating for a turbine unit is done in one boiler, a standard boiler (without reheat) having been installed to furnish the required amount of steam to each unit in excess of 500,000 lb. per hour and also to assist in reheat temperature control. The heat balance is similar except that drip pumps are used on the low-pressure heater only and one of the turbines driving the secondary boiler-feed pump takes steam from the cross-over and exhausts into one of the heaters. It was thought that the complication and probable difficulty with small drip pumps operating at high pressure would more than offset the small gain in efficiency.

There is one set of feed pumps and a spare for each unit. The primary pumps are driven by constant-speed motors and pump through the heaters to deliver water to the secondary pumps at about 650 lb. pressure. The secondary pumps are turbine-driven and maintain 1,625 lb. pressure in the feed lines. Two of the secondary pumps, one for each unit for normal operation, are each driven by two 1,250-hp. turbines, one taking steam from the exhaust of the high-presure turbine and exhausting into one of the feed-water heaters and the other taking

Cost is no more than for lower pressures

No inherent difficulties due to pressure are found

Operating experience shows flexibility and fuel economy over lower-pressure plants

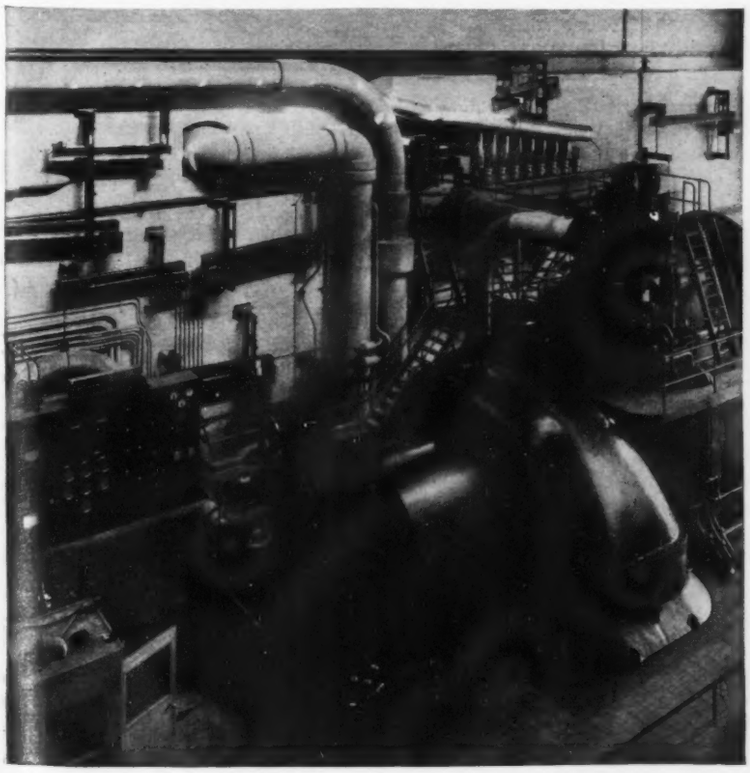


Vertical compound 50,000-kw. units in station A, San Francisco

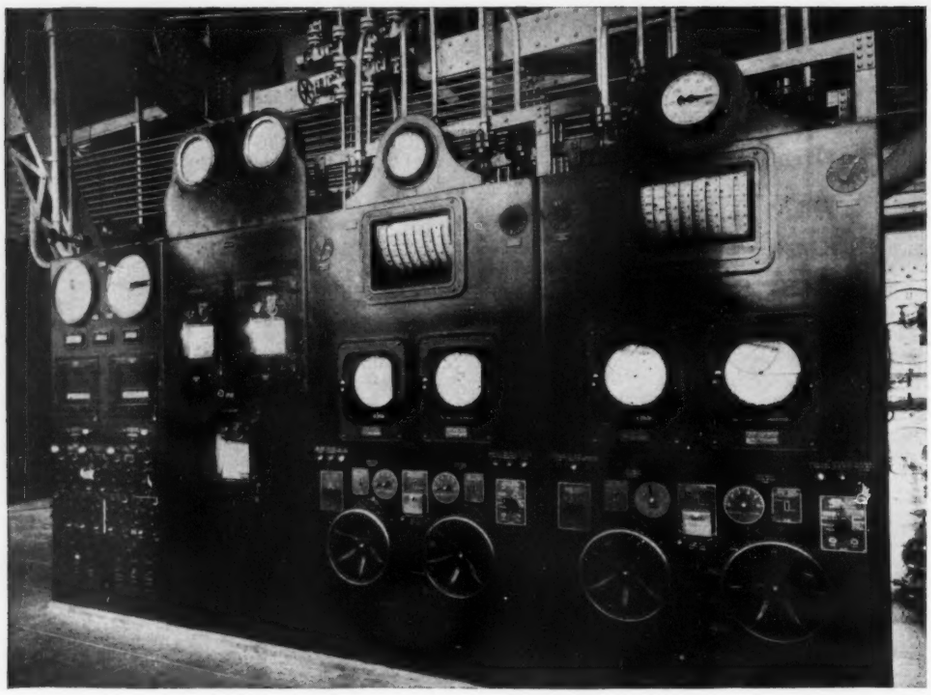
325 lb. steam from the auxiliary steam line and exhausting into the main condenser. The back-pressure turbine operates at all times with wide-open throttle, and the regulating is done at the throttle of the condensing turbine, which is controlled by the automatic feed-water control system. The spare pump is driven by a condensing turbine only. This arrangement gives a very flexible and simple control and is almost as efficient as taking power from the main unit. Moreover, the size of the boiler reheater is reduced and for a given pipe size there is less pressure drop in the cross-over line between the high-pressure and low-pressure turbines.

No additional condenser capacity is required, since with full load on the main unit the non-condensing turbine just about carries all the pump load. The 325-lb. auxiliary steam is supplied by two reducing valves from the 1,250-lb. lines and a 900-hp., 350-lb. boiler installed some years ago. The feed pumps and control system have given exceptionally good service, no adjustments or changes of any kind having been required on the part of the pump manufacturer. All other auxiliaries are motor-driven except the steam-jet air pumps, which operate on 325 lb. steam.

The high-pressure steam and feed-water piping is made up principally with welded joints, though there are a few small tongue-and-groove joints. The reheat piping for 500-lb. working pressures and the 600-lb. feed-water piping are made up with small tongue-and-groove joints, and the 325-lb. auxiliary steam piping has raised face joints with phonograph finish. All gaskets are plain monel. The high-pressure and reheat steam piping is carried almost entirely upon counter-



Steam end of No. 1 unit, showing high- and low-pressure turbines



Main boiler-room-control board

weighted supports. There are no anchors, and the boiler and turbine nozzles take all the axial reactions.

Why 1,250-lb. steam pressure

A high-pressure plant is no longer a novelty, and while there is a decided trend toward the use of 1,250 lb. it is a question in the minds of many whether, on the whole, some lower pressure, say 600 lb., is not more desirable. The installation at station A should be of interest for a number of reasons:

1. It is the rebuilding of an old and obsolete plant with very little change in the building and circulating-water system.

2. It was not designed as a base-load plant, but to operate under the same conditions as other plants on the system; that is, to supplement the power deficiencies of a large water-power and transmission system and to take the swings and bumps incident to such a system. Part of the time, in the spring when stream flow is ample, the operation will be simply that of floating on the system as standby service, and later in the summer, when the stream flow is low, the plant will operate most of the time at full capacity.

3. The units, boiler and turbine, are the largest high-pressure units to date.

The answer to the question of why 1,250 lb. was selected is that careful estimates showed that the use of this pressure would cost no more than the use of 450 lb. It was believed that in the matter of flexibility and reliability it would meet the service requirements just as well as with some lower pressure and that the fuel savings would be very material. Experience with high-head water-power plants up to the order of 1,000-lb. pressure over a long period had shown them to be just as good as low-head plants, and there could be seen no inherent disadvantage in the use of high pressure.

The installation was designed by the engineering department and constructed by the general construction department of the Pacific Gas & Electric Company. The unit was put into operation by the regular operating staff at station A without any previous experience with modern equipment. In other words, this installation followed the usual routine of the company's practice.

The total expenditure for the high-pressure installation will be about $7,250,000. This includes costs for the removal of old equipment, also all costs for temporary and permanent work required to keep the two remaining 200-lb. units in service. The electrical switch house, stack and certain other items constructed at this time are sufficient for the ultimate plant of four units.

The experience of five months' operation merely confirms the view of other operators of 1,250-lb. plants, that no difficulty can be attributed to high pressure and that pressure is simply an incident of design. Manufacturers are able to predict performance just as well as for lower pressure. The boilers have put out 510,000 lb. of steam per hour each, and the No. 1 turbine has carried a maximum of 68,000 kw. The vertical arrangement has been entirely satisfactory and no operating disadvantage has been found to date. On the whole, the various pieces of equipment have come remarkably close to estimated performance, and any deviations have been for the most part on the favorable side. Steam temperatures have been well up, running 750 deg. to 760 deg. F. at the high-pressure throttle with the reheat temperature a little high at about 775 deg. F. The reheat temperature is easily held at 750 deg., however, by proper loading of the standard boiler. There has been no difficulty in maintaining 1,250 lb. at the throttle at all loads, since the drop between the drum and throttle is only about 75 lb. at maximum output.

From a cold condition a boiler is put on the line in four hours and the turbine is up to 65,000 kw. in one and one-half hours. These are normal starting times and could probably be materially shortened in an emergency as the units appear to be just as rugged as those built for lower pressures.

The few leaks in piping and boiler units that have occurred have caused no damage and are no more troublesome than those occurring with low pressures. They are allowed to go until a shutdown is convenient.

Out of a possible service time of 3,560 hours since first started, the units have been on the line 2,910 hours.

The low-pressure turbines are equipped with valve gear to enable them to be operated alone on high-pressure

steam. This method of operation has been thoroughly tried out as well as operation compound of the units on the standard boiler alone without reheat. The units have been operated a total of 219 hours compound without reheat and 323 hours with the low-pressure turbine only. Of couse, under neither of these conditions is the operation efficient, but they are satisfactory for emergency service with the reheat boiler of the high-pressure turbine out of service.

High economy shown

Up to July 1 the units had generated a total of 104,590,000 kw.-hr. with a net of 98,245,000 kw.-hr. This is 6 per cent for auxiliary use, and the average net output was at the rate of 13,100 B.t.u per kilowatt-hour. The capacity factor was about 45 per cent. During this period, which included operating without reheat and with low-pressure turbine only, conditions were not favorable to efficiency. Attention of the operating staff was directed principally to adjustment of equipment. All the circulating pumps had not been installed, and on account of load conditions which required the old 200-lb. turbines to be operated there was a shortage of circulating water and the vacuum for considerable periods was about 3 in. absolute and at times as much as 4 in. There was also an excessive demand for make-up, and one or both the evaporators were on the main condenser with steam reduced from 1,250 lb. These conditions are now cleared up.

With 1,250 lb., 750 deg. F. throttle steam, 750 deg. F. reheat steam temperature and 1.6 in. vacuum, the daily net is averaging about 12,000 B.t.u. per kilowatt-hour, with 5 per cent for auxiliary use. The best daily efficiency obtained has been at a rate considerably better than this figure; however, this was with only one turbine and boiler operated continuously for twenty-four hours at about 40,000-kw. load. In considering these figures it must be remembered that the boilers are fired with natural gas and the boiler efficiency is low, being of the order of 83 per cent only, with a stack temperature of 350 deg. F.

The general conclusions reached by the writer as regards the use of 1,250-lb. steam pressure are:

1. That such plants for steam temperatures up to 825 deg. F. cost no more than plants for lower pressures with comparable steam and stack-gas temperatures, vacua and equivalent automatic control.

2. There are no inherent difficulties due to pressure, and the equipment is as rugged and flexible in operation as with any other pressure for the same temperature.

3. The so-called complication of reheating is more apparent than real, and the use of any temperature sufficiently high to equal without reheat the efficiency of the 1,250-lb., 750-deg. F. (or possibly 825-deg. F.) reheat cycle may involve considerable development work.

4. The considerable reduction in weights and volumes of steam, feed water, cooling water and fuel, with attendant reduction of boiler and condenser surfaces, is a fundamental factor toward the amelioration and final elimination of many steam-plant tasks, such as maintenance of clean surfaces, furnace maintenance, prevention of condenser-tube corrosion and leakage, and coal and ash handling in coal-burning plants.

▼

Air Patrol Effective in Upper New York

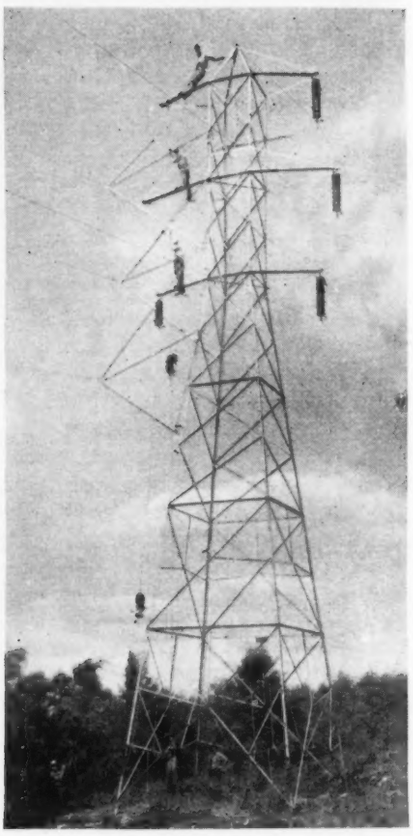
A year ago it required a crew of eight men twelve hours to tramp over a 35-mile section of transmission line right-of-way to patrol the lines of the Northern New York Utilities Company. Today an airplane saves many weary hours of walking and expedites this function. It flies 80 to 100 miles per hour about 50 to 100 ft. one side of the right-of-way and about 100 to 200 ft. above the ground.

It is pointed out by the company that even at this speed there is time to observe failures, but the observer must know the tower numbers and be familiar with the maps of lines over which the plane is flown. Observations are transmitted by dropping notes at the nearest substation or by telephone when the plane lands.

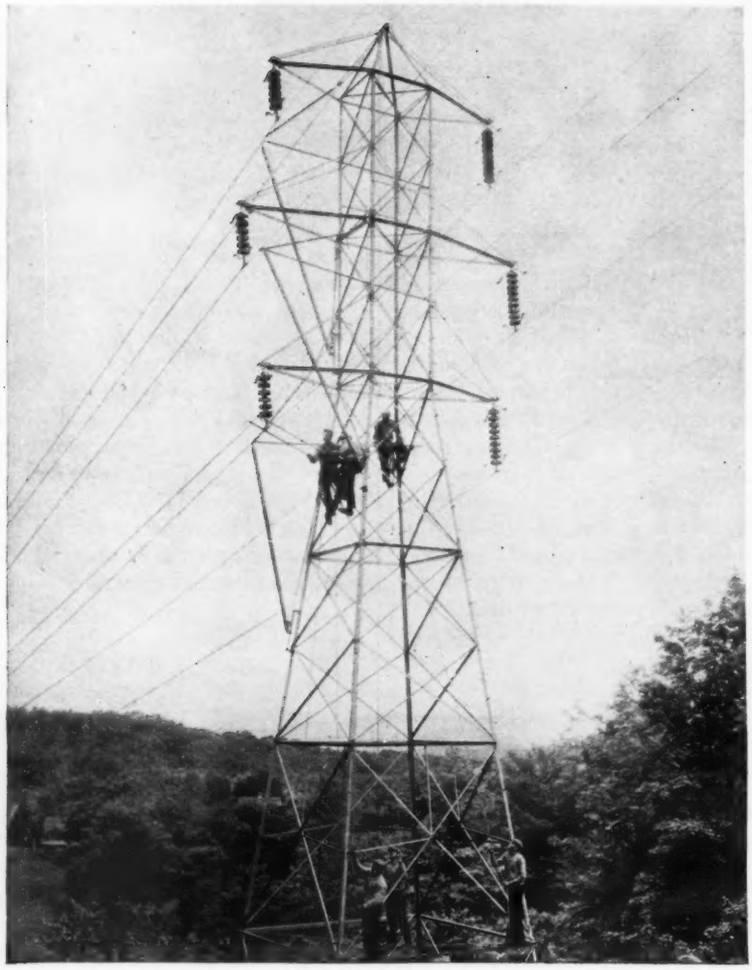
The first air patrol of these lines was made in June, 1929. A severe electrical storm had put important lines out of service. The entire construction crew had to leave various duties to patrol the seven 110,000-volt lines. A plane observer flew over each line twice, covering 300 miles in six hours, and was able to discover every flashover reported by the ground men as well as an additional shattered unit.

Planes are now used regularly to replace or supplement ground patrol

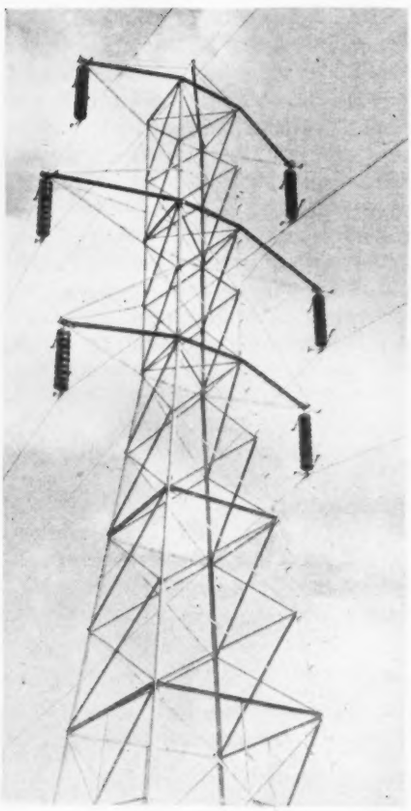
Four Towers per Day
Changed from 69 to 115 Kv.
While Alive



Lowering old and hauling up new insulator units while live circuit is held away from tower by tools attached to framing



Applying special live line tools to 69-kv. circuit in disconnecting old insulators



Completed live line work in which number of insulator disks was increased from six to nine for operation at 115 kv. without circuit interruption. This is the Cabot-Pittsfield circuit of the Turners Falls Company

Utility Securities Sound Investments*

Present conditions prove earnings stability. Future prospects equal to past accomplishments. Management record excellent and agitation ineffective

By MATTHEW S. SLOAN
President New York Edison Company

UTILITY securities have been on the legal list of savings banks in New York now for three years. You, through your association, are probably familiar with the amount purchased. I am informed that the volume of purchases increases from 60 to 90 per cent yearly, and that on January 1 of this year your banks had invested in utilities three times the total amount held January 1 two years ago.

This trend coincides with that manifest by other institutional investors. The utility industry is proud of such investment—we don't mind admitting that. We feel we are entitled to interpret it as a tribute to our financial position and administrative ability. We believe such purchase of utility securities is mutually advantageous—good for you and for us. But we are not hesitant in saying that institutional investment is an important element in our financing.

The utilities by their record have proved their securities desirable investments for institutions. They have maintained that position even during the depression. But conditions change and types of securities once good may thereafter become not so good. What of the future of the utilities?

Speaking of the electric industry, with which I am associated, I can see in the future only an enlargement of its usefulness, an increase of its sales and beneficial working out of such problems as it now has. The prospect for the gas industry is, I believe, also favorable. Changes are now coming about because of the great activity in natural gas fields, but their results, so far as I can see, will be beneficial ultimately in that gas will sell more widely for industrial processes and probably house heating in many territories.

It was only in 1882, when Edison opened the Pearl Street plant in New York City, that the electric utility industry began. The company was capitalized at a million dollars. It lost money the first year of its existence. The investment of the electric utilities now is approximately twelve billion dollars. Comparing 1930 with 1912, the population of the United States has increased 29 per cent. The investment in electric utilities has increased more than 400 per cent. Gross revenues have increased more than 600 per cent. The number of customers has increased more than 500 per cent. The number of persons living in homes having electricity has increased 500 per cent.

**Abstract of address before the Savings Banks Association of the State of New York, Niagara Falls, September 18, 1931.*

Future equal to the past

I have no hesitancy in saying that the growth of the electric utilities in the next couple of decades will equal that I have just indicated. Indeed, it probably will exceed it. Growth from increase of population and the acquisition of new customers has by no means reached its limit, though such increase is now slowing up compared with earlier years. The big field ahead of the electric companies, however, is growth of business by way of new uses of current and growth by way of increased use by customers on the lines. For example, there are some twenty million homes having electric service now. Surveys have indicated that even the largest users of electricity among them use not to exceed one-third of the current which might advantageously be applied to home electrification in the present stage of the art. Development of this market alone would show increasing sales for many years to come. Ahead of us, but not far ahead, are such home applications as air conditioning, now limited to only a few commercial applications, and illumination by electricity duplicating sunlight, also in use now in a few commercial installations.

When we mention power, we think of electricity. Yet today only 75 per cent of factory machinery is electrified and only 50 per cent of it uses current supplied by utilities. There is another large field for future cultivation. Commercial and industrial lighting, street and highway lighting, electrification of office equipment, electrification of store equipment, refrigeration, all will add large future loads to the lines of the utilities. Then there is railway electrification, only well

begun, but which has so demonstrated its value that wide extension by current purchased from utilities is only a question of time.

All these extensions of business will come because the electric utilities are virile and they are efficient. They are doing two phases of their job today as they have never done them before. One is selling. There was a time when the companies were order takers, rather than merchandisers, of electric service. Demands for service kept them busy building to supply them and they didn't have to give much attention to selling. That period has passed. Even before the depression the utilities had found that they must get out and sell their service if the rate of growth were to be maintained. The depression hammered home that idea, and experience has proved that the job could be done even under unfavorable circumstances.

The second phase of the job to which I have alluded is the introduction of economies. Recent years have produced many means of lessening the expense of operation. Bigger and more efficient generating machinery has made great savings in coal. In 1902, on the average, it required nearly 7 pounds of coal to make a kilowatt-hour of current. By 1917 this was cut to 3.3 pounds, while last year's average was only 1.62 pounds. Many plants bettered this. Development of water powers and their interconnection with steam plants in many parts of the country has produced economies. Merging of companies and grouping of companies under common ownership of holding companies have also produced economies. Such means of reducing operating cost have not reached their end. Other savings lie ahead in the reduction of the cost of transmission and distribution of current—a phase of the business where really important cost reductions will be made in coming years.

Improvements in these two branches of activity link closely together, as where sales result in a greater density of load in a given territory, costs per unit of electricity naturally become less. Economies and increasing efficiency reduce costs per unit. As costs per unit become smaller, prices can be made smaller. This makes possible more sales, increasing the density of load, tending to produce further price reductions, and still further to increase the load. That is the trend in the electric utility industry. That is why we may confidently look forward to increasing load to an extent which at present would seem almost beyond belief.

Price within consumer control

I have said many times that the price today for electric service was within the consumers' own control. Critics of the utilities may think that is a bad joke. It isn't. It is cold economics. No one customer, of course, can control rates, but as the customer group uses more and more current, as load density in a given territory increases, prices are bound to decrease and the utility sells more current at a smaller unit price for the same amount of money. Rate structures are built on that basis in ever larger numbers. Good engineering, good salesmanship, good administration all operate to that end. The customers benefit and the utilities profit by a very small margin on a large volume of sales.

We have seen this economic principle at work over a period of years, and it is, in my judgment, only well begun in showing its benefits. Not many months ago the Bureau of Labor Statistics of the United States Department of Labor made up figures showing that the average price of electricity for domestic use had declined 18½ per cent since 1913. This contrasted with increases in all other necessities, varying from 8.1 per cent for a group of miscellaneous items to 88.3 per cent for house-furnishing goods. That figure for the cost of electricity was based on an average use of 20 kw.-hr. a month. Figures compiled by the National Electric Light Association covering all residential use showed a decrease in the average price of 30 per cent since 1913.

On the average, a householder pays less than a dime a day for electricity used. Please consider that. Only a dime a day per household to buy what electricity represents in a home. And inevitably in future lower unit prices will come as use increases.

That is the basic reason why the utility industry is no more disturbed than it is by the present political drive against it. That is the reason why investors in utility securities, individual or institutional, need not be disturbed by the antics and the fulminations of vote-seeking politicians. We in the industry find that criticism and antagonism seldom originate with customers, but are spread by those with axes to grind. I am not pretending to say, mind you, that the rates of all companies are what they should be. I am not pretending that all utility managements are free from mistakes or that there are no evils in the industry to be cleaned up. It is a huge industry, made up of many units, and many types of individuals. And organizations and individuals vary in policies, practices and points of view.

Yet the record stands that company by company, year by year, residential rates have been reduced until the average American home pays less each day for the electricity it uses than the price of a shoe shine, or an ice cream soda, or a moderately priced cigar. It would be hard to find a community in this broad land where rates for electricity have not been reduced once or twice in the last few years. The public, therefore, finds itself unable to become excited when it is told that the electric utilities are hand in glove with corruptionists and racketeers, and each year rob the people of a half billion dollars or more. It remains calm or indifferent when told that public regulation of utilities has failed and the interests of the people are imperiled. It yawns at the debate over valuation on the basis of prudent investment versus reproduction cost less depreciation. Ex-Governor Smith, for whose common sense and political sagacity I am sure we all have great respect, said a while ago that there was nothing in the utility issue, so called, because the people do not understand the matter. I think that is true. They don't understand the intricacies of law and accounting brought forward in an effort to construct a vote-making issue. They do understand, however, when their rates have been reduced and they pay lower prices and get more for what they spend.

No alarm about government ownership

That is the reason I am not alarmed by the demand for government ownership and operation of the utilities, which is the ultimate object of this political campaigning. The American people are sensible, take them by and large, and they are fair. They may not under-

stand—I am not at all sure they want to understand—the technicalities of law, accounting and economics which attend the operation of the utility business, but they understand results in lowered rates. They are entirely competent to contrast those results of benefit to them with the steady increase of taxes in all branches of government that is an ever-growing burden on their backs. They have seen our federal government undertake war-time operation of railroads and shipping at vast loss. They have seen in several of our states disastrous outcome of government operation in various businesses. They have seen abroad the abandonment of government business undertakings. They have seen recently the practical bankruptcy of Australia, which traveled further along the road of socialism than any other country except Russia. These are the things I am sure they do understand, so I am confident they are not going to put the government into the utility business at the behest of intellectual enthusiasts, however sincere, or of politicians after votes, however eloquent.

I have gone over these various phases of the utility situation, gentlemen, in order to let you see why I consider good utilities desirable investments for institutional purchasers and why I believe they will continue to be so. The utilities have done a good job, both as a business and an agency of public service. They are capable of doing a better job in future. They have suffered in this business depression, but less than any other business I know. And when we pass out of this period, they will make rapid strides forward. Their managements, being human, are certainly not enjoying the present campaign of criticism and abuse, but so far as any criticism, either of policies and practices or of conditions of public regulation, is well founded, the managements, I am sure, will be as anxious as anybody else to correct mistakes or abate evils.

We of the utilities have no fear that the business will be taken away from private ownership and management and turned over to government ownership and operation. We look ahead to a future of increasing prosperity which we shall earn by increased usefulness to our customers. There is in the industry the ability and the will to make such a future, building soundly and progressively on what has already been done. It would be possible to talk for a day and still not give you the entire picture. You have found utility bonds good investments so far in your experience. I believe that, properly selected, they will continue to be good investments.

▼

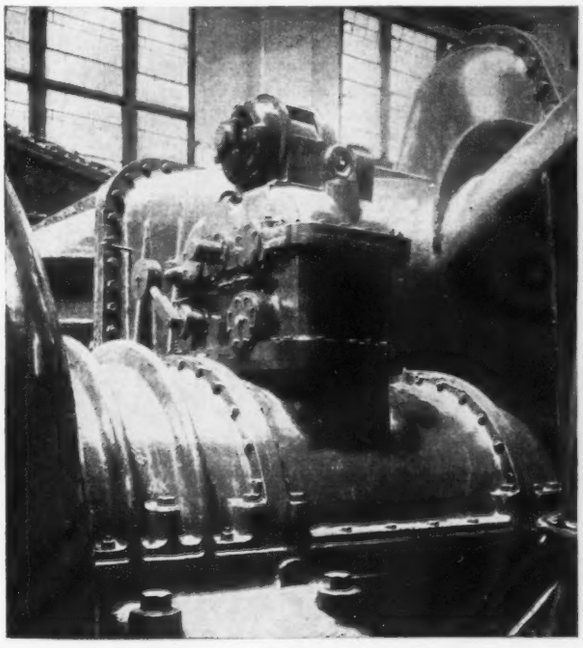
A Recent Adjunct to Turbine Operation

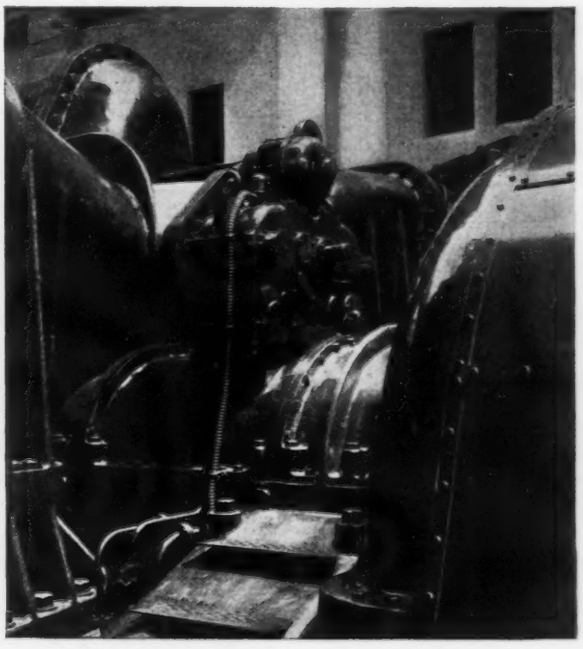
A new auxiliary has been applied to one of the 100,000-kw. turbo-generators at the Long Beach plant of the Southern California Edison Company to serve two purposes. It is used to start the unit from dead rest without the use of steam, but its principal purpose is to rotate the spindle and shaft slowly when the throttle is closed so that they will not be warped by uneven cooling.

As pointed out by F. G. Philo, superintendent of steam generation, when a turbine is shut down and the spindle is allowed to come to rest, the lower part of the casing cools more rapidly than the upper half. This uneven cooling bends or distorts the spindle shaft. To start a turbine when this condition exists requires the greatest care, and under some circumstances starting must be delayed considerably. The rush of steam that must be admitted to a turbine to start the shaft turning tends to heat the spindle unequally and results in distortion. Before the rotating device was applied to the unit at least one and one-half hours was required to start. Since the application of the rotating device the unit has been put on the line in 30 minutes.

In an emergency in which a large unit is needed on the line as quickly as possible the time saved by the

Rotating device mounted on coupling housing of 100,000-kw. turbine





rotating device is immeasurably valuable. In addition to this starting advantage the rotating device serves largely to protect the turbine blading.

This auxiliary consists of a motor-driven train of gears operating through pawls on a toothed ring attached to the coupling between the turbine and the generator. The gear train is driven by a two-speed induction motor. At a motor speed of 564 r.p.m. the turbine shaft turns approximately $\frac{2}{3}$ r.p.m. and 5 hp. is required. At a motor speed of 950 r.p.m. 10 hp. is required to rotate the turbine shaft approximately $1\frac{1}{3}$ r.p.m.

To start the turbine from dead rest the low-speed winding of the motor is first used, switching to the higher speed before the throttle valve is opened. Oil is supplied to the bearings at about 20 lb. pressure by an independent motor-driven pump.

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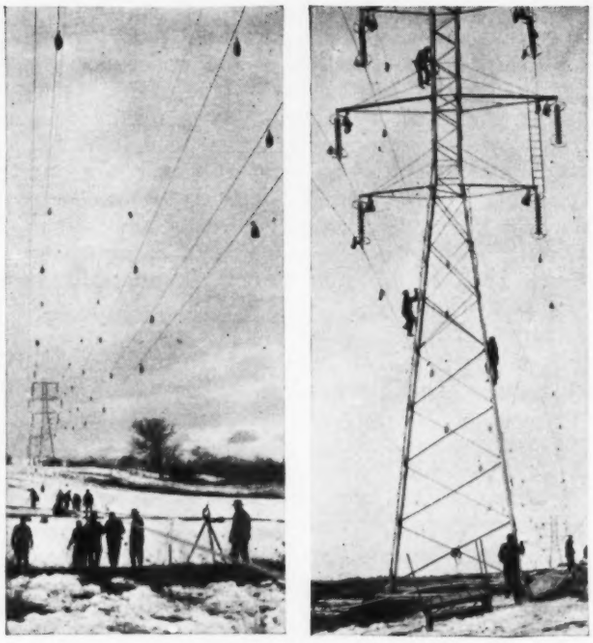
Field Tests to Simulate Ice and Wind Loading

Field tests to determine the ability of a new type of transmission tower to withstand unusual strains have been made by the New York Power & Light Corporation by weighting the conductors with sandbags to simulate ice loadings and subjecting the towers to a transverse stress equivalent to the wind stresses. Then two conductors were cut in succession to determine the unbalancing effect on the tower. More than 500 sandbags with a total weight of 25 tons were used to load the spans on each side of the tower, this being the calculated equivalent weight of the $\frac{1}{2}$ in. of ice coating on the wires and towers. A 5-ton transverse pull on the tower was calculated to simulate the effect of a 60-mile gale.



Towers being subjected to field test

Under these tests the tower failed to show any signs of damage. The only noticeable effect of cutting the conductors was slipping of the wire in the safety clamp.

The tower tested was on the company's 110,000-volt Thompson-Greenbush line and corresponds to those used on the New York City tie line.

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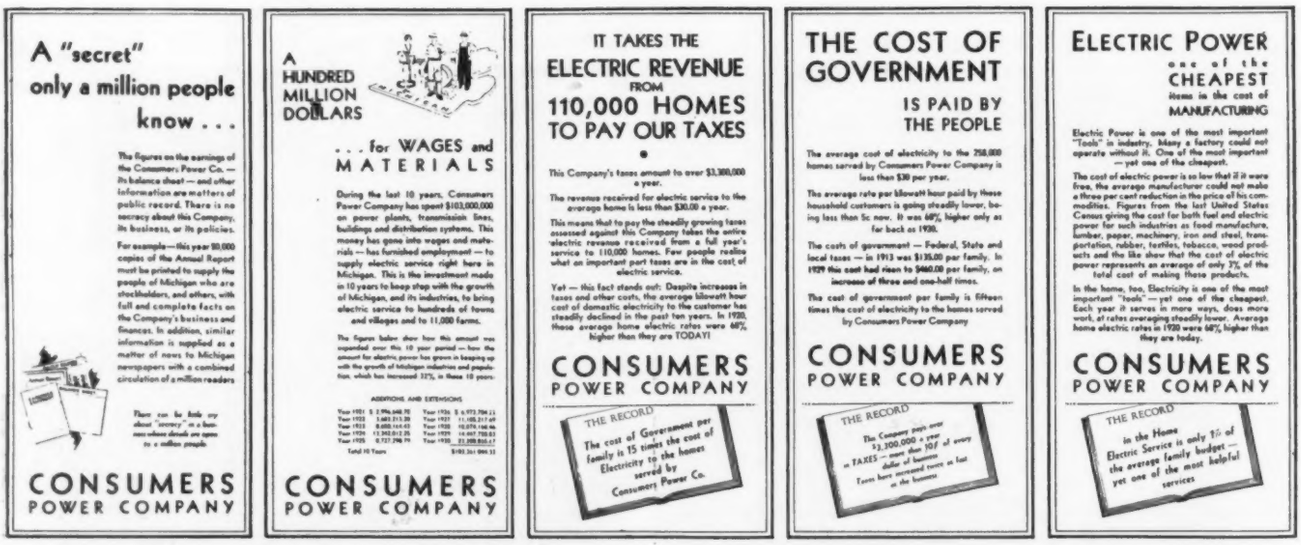
Getting Appeal Into Advertising


A "secret" only a million people know . . .
CONSUMERS POWER COMPANY
A HUNDRED MILLION DOLLARS
. . . for WAGES and MATERIALS
CONSUMERS POWER COMPANY
IT TAKES THE ELECTRIC REVENUE FROM 110,000 HOMES TO PAY OUR TAXES
CONSUMERS POWER COMPANY
THE COST OF GOVERNMENT IS PAID BY THE PEOPLE
CONSUMERS POWER COMPANY
ELECTRIC POWER one of the CHEAPEST items in the cost of MANUFACTURING
CONSUMERS POWER COMPANY

Represented are reduced reproductions of just five of a series of advertisements which the Consumers Power Company is running in newspapers. They have appeal in their headings, and convey some facts that the public might miss if buried in longer presentations. But the problem ahead is to break down the general criticisms which are hurled against utilities and holding companies into their elements so they can be answered specifically but briefly to the satisfaction of the public. Most of the criticised practices can be justified if some one is ingenious enough to devise a method of maintaining reader interest until the subject is treated. Apparently, the secret is to discuss everything in terms of the customer's problems or self-interest.

Transmission Line Analysis Indicates Ruling Tendencies

By Professor E. B. KURTZ* and J. A. DOUGLAS†

A DETERMINATION of the relations between the major design values of present-day electric power transmission lines was undertaken in the belief that a study of a large number of lines would reveal the general laws governing recent design practice. The analysis was based on the table on "Engineering Details of Transmission Lines in the United States," which was published by the ELECTRICAL WORLD in 1929. This table gives the engineering details of 877 high-voltage transmission lines.

The graphical method was chosen as best suited to indicate the relations sought from among the hundreds of tabulated values. It was first attempted to plot each point individually on large scale co-ordinate paper. In several cases this procedure so crowded the points that the center of gravity was obscured. This difficulty was overcome by summing up the values of all the items in a group and then dividing this sum by the number of items in the group.

The average value that was thus obtained was plotted as a circle of such size that its area represented the relative number of readings used to determine it. A curve was then drawn through these points, giving weight to the size of the circles, and the empirical expression for the curve was then determined. The following terms were found in the analysis:

"Megavolt-ampere-miles" represents the effective load on a line, for it combines the magnitude of the electrical load with the distance over which it is transmitted. The product of electrical load and line length is more representative of the work done by a line than either load or line length alone. The value of this term is obtained by multiplying the volt-ampere rating of the line by the length of the line in miles, reduced to the mega unit.

"Span-amperes" represent the product of conductor current at the normal rating of the line, and the span length in feet between line supports. It is a unit which reflects both the electrical and mechanical duties of the conductor, and hence should be more closely related to the conductor size than either line current or span length alone.

Voltages apparently headed for further rise

Voltage versus Megavolt-Ampere-Miles.—The accompanying table shows the calculations required to obtain the averages of megavolt-ampere-miles per line for each of the voltages. The values shown in the table are plotted in Fig. 1. A curve developed by Prof. D. D. Ewing in 1919 and published in ELECTRICAL WORLD, Vol. 74, page 406, is also shown on the figure for comparison.

These curves show clearly that higher voltages are being used in the transmission of all loads. The upper portion of the curves seem to indicate that voltages will

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†Instructor in electrical engineering, Stevens Institute of Technology, Hoboken, N. J.

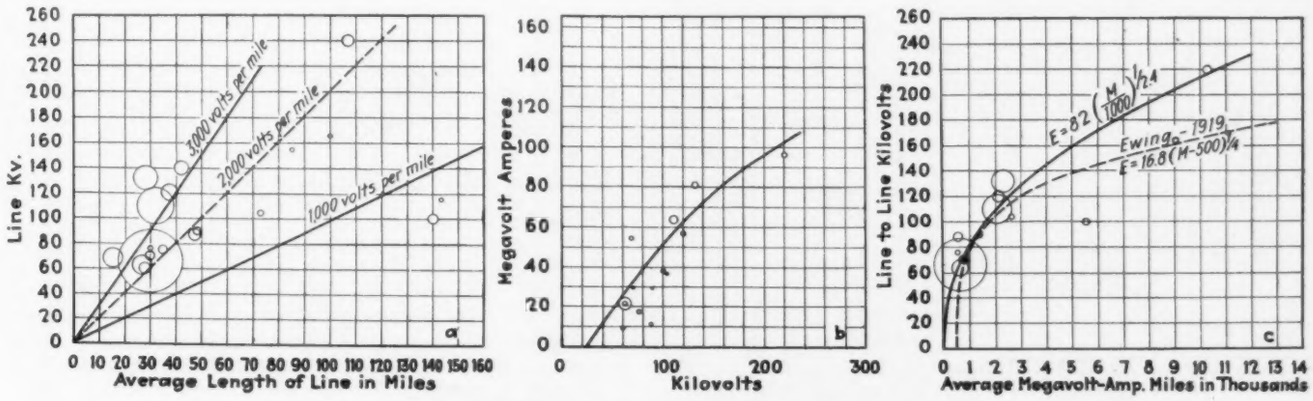
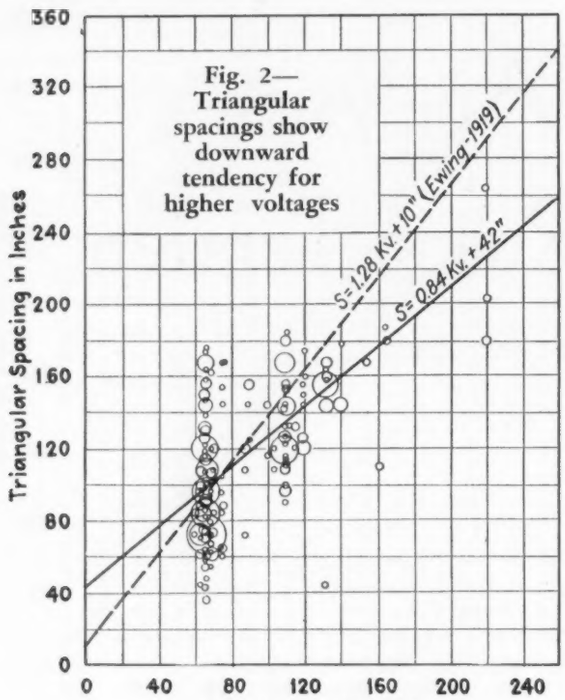
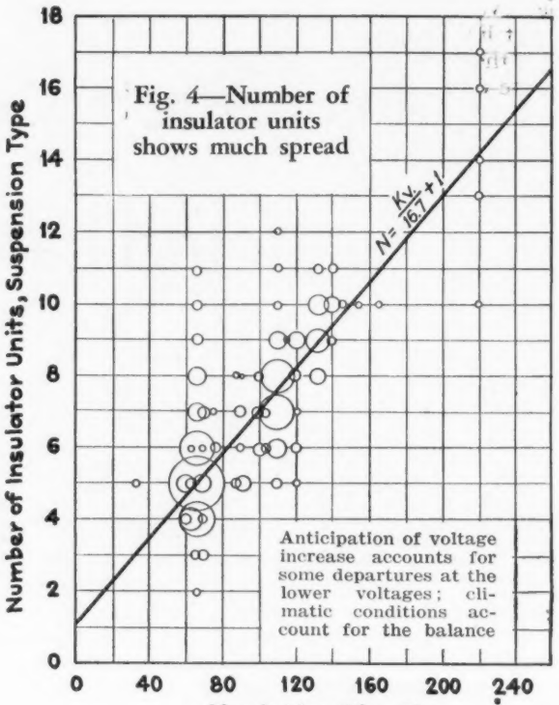


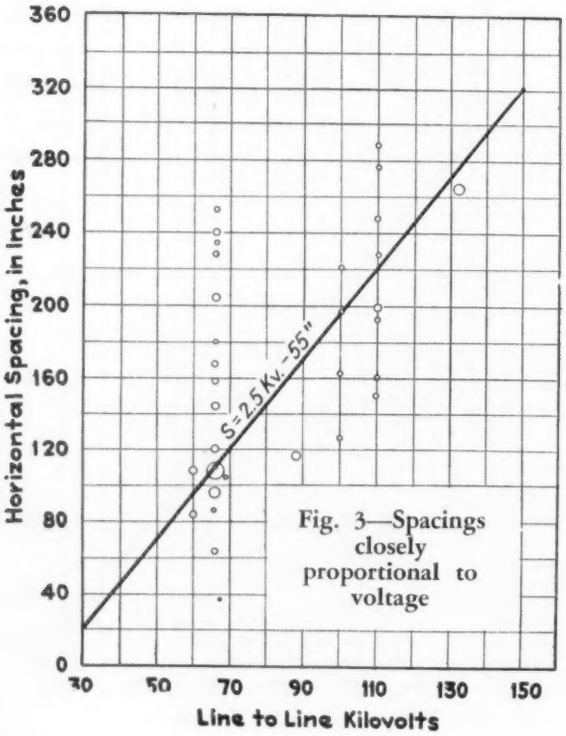
Fig. 1—(a) "1,000 volts per mile" no longer holds. (b) Voltage is related to line load. (c) Voltage is closely related to load-miles

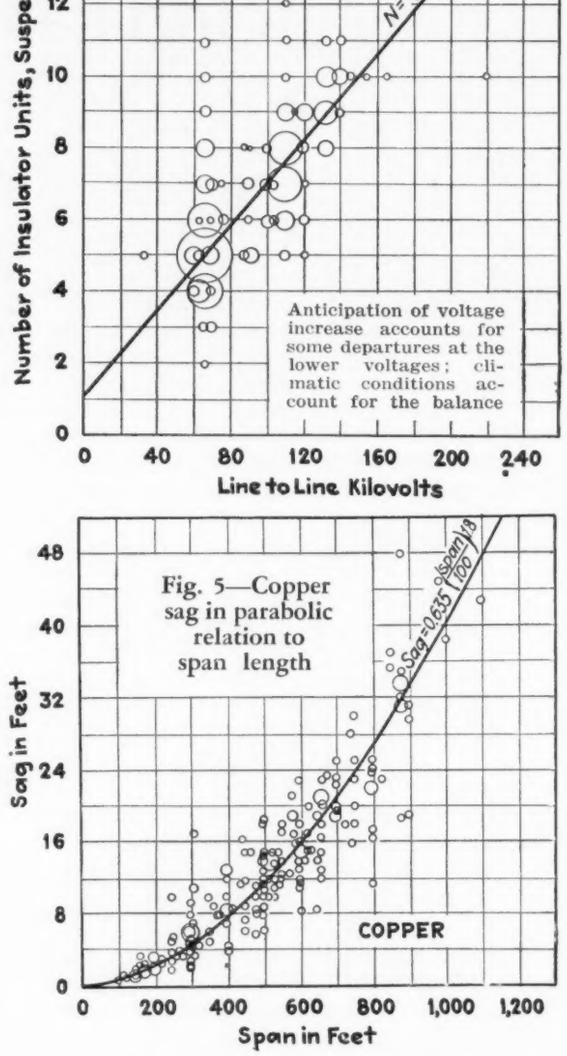


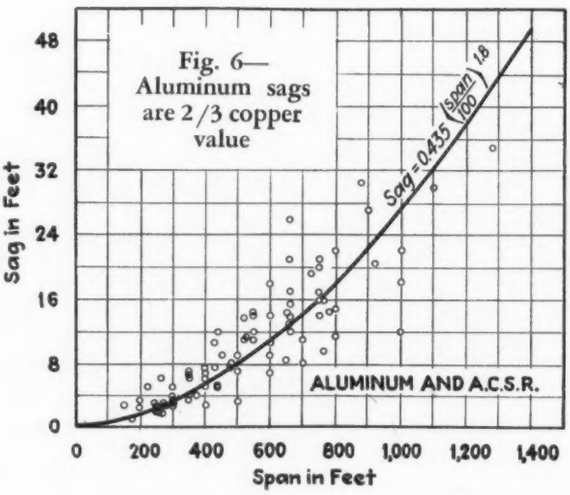


continue to be raised on lines of all lengths. It also seems probable that in the near future the curve may intersect the voltage axis above the origin, thus indicating a minimum potential for all lines, regardless of length or electrical load.

The fact that the product of volt-amperes and miles is related to the line voltage shows that high voltages are not only used with long lines but also for shorter lines







delivering several times as much power. It used to be believed that line voltage was only related to the length, as given in the rule "1,000 volts per mile," but such is far from the case today. The product relation is much more reasonable, for it takes the two factors into account which determine whether the use of any given voltage is economical or warranted.

Voltage versus Conductor Spacing.—Figs. 2 and 3 show the relation between line voltage and conductor spacing for triangular and horizontal spacing respectively. Triangular arrangements of the conductors are the most numerous. Fig. 2 also gives comparisons with Professor Ewing's findings in 1919. Ewing's equation for 1919, taken in connection with the practice in 1929, shows that there has been a slight decrease in the spacing in use with the higher voltages. The increase of spacing at low pressures may be misleading, as many lines now operating in the neighborhood of 66 kv. are spaced for ultimate operation at 110 kv.

Consistent practice as to number of insulator units

Voltage versus Insulator Units.—The relation between line voltage and number of insulator units in suspension strings is shown in the Fig. 4. The linear relation is very pronounced and shows a fair uniformity in practice throughout the country. The use of an excessive number of units in several cases at the lower voltages may be in anticipation of a voltage increase.

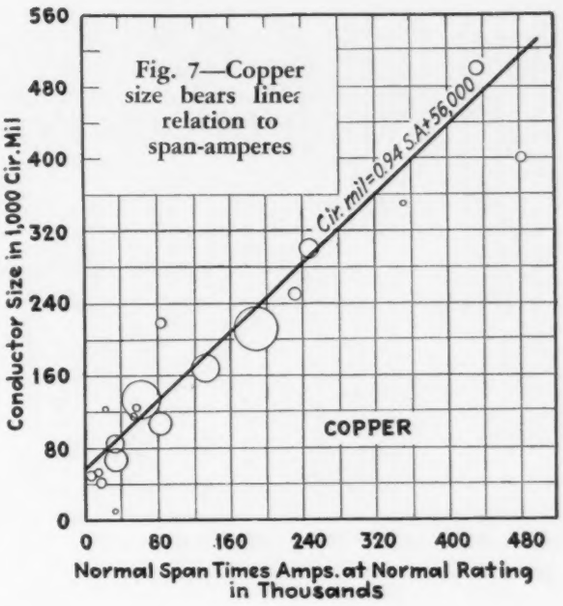
Average Values of Megavolt-Ampere-Miles per Line and Average Lengths of Line for Each Voltage Class

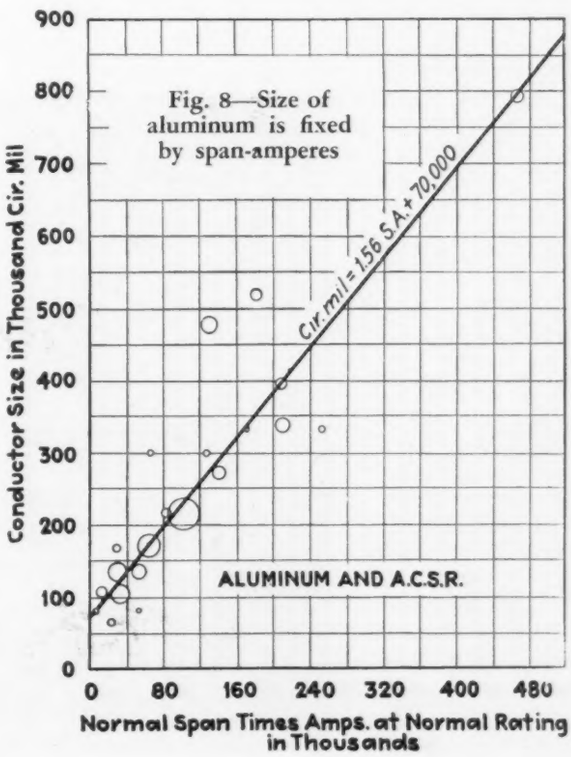
Line Kv.	Megavolt-Ampere-Miles	No. of Lines	Megavolt-Ampere-Miles per Line	Total Length of Lines, Miles	No. of Lines	Average Length in Miles per Line
60	1,270.9	5	254.18	338.33	12	28.19
63	17,670.7	29	609.85	1,022.15	37	27.63
66	178,958.97	287	623.55	11,340.28	388	29.23
69	3,650	4	912.5	536.14	32	16.75
70	4,400	5	880.0	147.00	5	29.4
75	.....	...	.....	175.65	5	35.13
76	1,082	2	541.0	60.50	2	30.25
88	4,396	8	549.5	572.97	12	47.75
90	7,175	5	1,435.0	242.81	5	48.56
100	16,601	3	5,533.66	1,405.86	10	140.59
104	10,682	4	2,670.5	295.78	4	73.95
110	187,643.5	91	2,062.0	4,399.14	136	32.35
115	17,240	1	17,240.0	143.60	1	143.6
120	27,738	13	2,133.7	903.94	24	37.66
132	115,567	50	2,311.3	1,628.22	57	28.57
140	.....	...	.....	726.33	18	42.35
154	.....	...	.....	85.70	1	85.70
165	9,020	1	9,020.0	100.24	1	100.24
220	82,801	7	10,257.2	1,171.59	11	106.51

Conductor Size versus Span-Amperes.—The relationship between conductor size and "span-amperes" is shown in Figs. 7 and 8 for copper and aluminum conductors respectively. The relation is very distinct and is linear in nature. As already noted, "span-amperes" is a measure of both the electrical and mechanical duties of the conductor. It is natural, therefore, that it should be closely related to the size of conductor used. It is realized that the wind and ice loading to which the conductor is subject is an important factor in determining conductor size or permissible span length. To show the effect of climatic conditions this part of the analysis should properly be made for each of the three loading districts.

Sag versus Span.—Figs. 5 and 6 show the relations between sag and span for copper and aluminum conductors. Both curves are of the parabolic type with an exponent of 1.8. The only difference between the two equations is in the values of the coefficients, which indicate that the sags for copper are approximately 50 per cent higher than those for aluminum for the same spans.

To sum up, it is believed that the relations shown indicate surprisingly definite trends and close agreements in the designs of high-voltage transmission lines. The curves and equations given may be used to compare any specific line now built or proposed against the standards of modern American practice.





Synchronous Motors Stopped in Three Revolutions

By A. S. RUFSVOLD
General Engineering Department,
Westinghouse Electric & Manufacturing Company

Meets emergency stop conditions.
Eliminates coasting time of heavy equipment.
Applicable to bandsaws, rolls, intermittent operations.

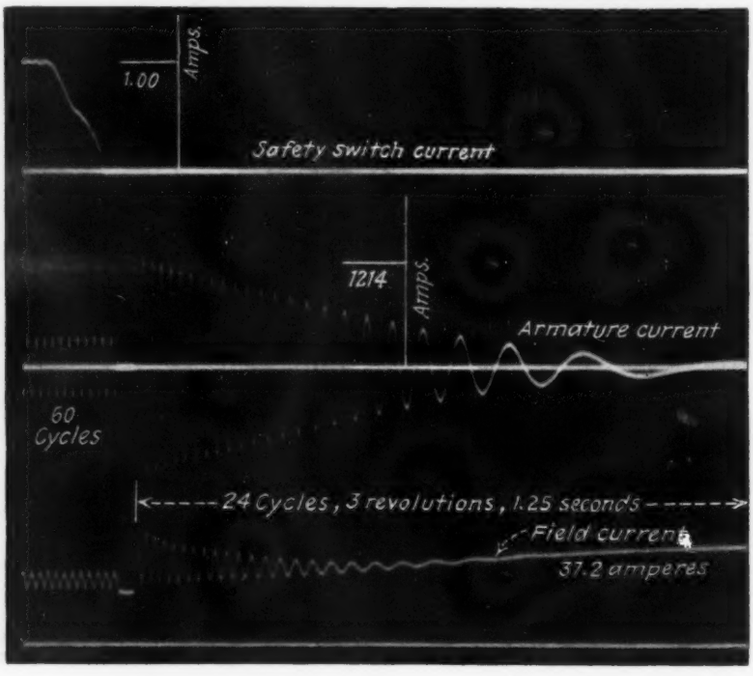
DYNAMIC braking is rapidly replacing mechanical brakes on applications requiring quick deceleration of synchronous motors. It is accomplished by transferring the armature connection from the alternating-current supply to a resistor, maintaining direct-current excitation on the field winding. Under this condition the motor acts as a generator, the stored energy of rotation being dissipated in the braking resistor. After the motor has been brought to rest the field excitation is removed, usually by some automatic means.

At any given speed the maximum braking effort, or kilowatt output, is obtained with a definite ohmic value of external resistance proportional to the speed, provided the field excitation is held constant. But in actual practice it is customary, and very satisfactory, to employ a single value of resistance during braking.

In cases where a very quick motor stop is desired the average braking torque with a fixed resistor may be increased by short circuiting the motor field rheostat during the braking period, thus raising the field strength as the motor decelerates. The increase in field excitation obtained in this way is usually quite effective in reducing the time required to bring the motor to a stop.

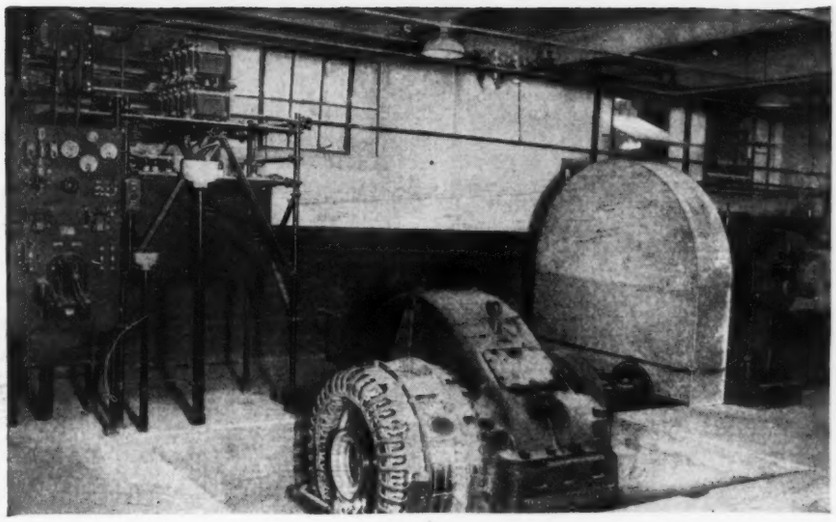
An oscillographic record of a dynamic braking cycle was taken on a synchronous motor rated at 400 hp., 450 r.p.m., 80 per cent power factor, 60 cycles. The motor tested was not connected to any load, so that it had only its own inertia to overcome. Dividing the number of cycles of armature current traced during dyamic braking by the number of pairs of poles (24 ÷ 8), it is seen that the motor made a total of only three revolutions in retarding from full speed to standstill. To the casual observer this might appear a rather severe condition for the motor, but as a matter of fact the electrical and mechanical stresses are both surprisingly low during such a braking cycle. The maximum armature current was only about twice the rated full-load current, which is less than half the current inrush during starting. Since most of the inertia of the motor is contained in the pole pieces adjacent to the air gap, where the braking torque originates, the stored energy is overcome without subjecting the motor spider or shaft to appreciable stress. The same condition holds true in cases where the motor is connected to a load of low inertia, such as rubber-mill rolls.

It will be seen from the oscillogram that the motor was brought from full speed to standstill in the surprisingly short time of 1.25 seconds. At the expiration of 1.0 second the speed had been brought as low as 27 r.p.m., or down to approximately 6 per cent of full speed. During the remaining quarter second the rate of deceleration was materially re-



From 450 r.p.m. to rest in 1.25 seconds

400-hp. motor stopped in three revolutions by allowing an armature current only half the inrush value at starting.



Slow-speed rubber mill drives stopped in one revolution

duced because of the diminishing generated voltage and the total time was correspondingly prolonged. As the motor speed approaches zero, the generated voltage and dynamic braking current likewise approach zero, which means that we must depend upon friction finally to bring the motor to rest.

At first thought this characteristic might be considered objectionable where a quick stop is desired, but analysis shows that the increased travel resulting from the tendency of the motor to "drift" during the latter part of the braking period is practically negligible. In the case illustrated the motor travel during the first second of time was approximately 2.97 revolutions, so that during the remainder of the time, or 0.25 second, the motor rotated only about 0.03 revolutions. Furthermore, the decrease in torque as the motor approaches standstill has the desirable effect of bringing the motor to a smooth and cushioned stop.

The maximum braking torque is obtained when the external resistance is equal to the reactance of the motor. Since the reactance changes with the speed, the maximum torque can be obtained at only one point on the speed curve when a fixed resistance is used. It is found that the minimum stopping time is obtained when the resistance chosen is such that the maximum braking torque occurs at 45 per cent of the initial speed. In the case of the particular motor tested, the initial torque at full speed was approximately 130 per cent of full-load torque, increasing to a maximum of 175 per cent at 45 per cent speed, then decreasing again to friction torque at standstill.

The effectiveness of dynamic braking can better be appreciated when it is known that during the one second in which the motor speed was retarded from 450 r.p.m. to 27 r.p.m. an average braking torque of approximately 150 per cent was developed.

Conditions for maximum braking torque

A quick stop, such as shown in the accompanying oscillogram, is utilized in rubber mills, where it is necessary to provide means for stopping the rolls quickly in case of emergency. In this case the dynamic braking feature is a safety measure for the protection of operators, and a quick stop is the important requirement. Fortunately, most of the stored energy of these drives is in the motor itself (the rolls being geared down to low speeds), and it is therefore possible to stop the motor sufficiently quick to prevent serious injury to the operator. On such drives it is not uncommon to bring a 600-r.p.m. motor from full-speed to standstill in three or four revolutions, and a 100-r.p.m. motor is usually stopped in less than one revolution, in both cases without load.

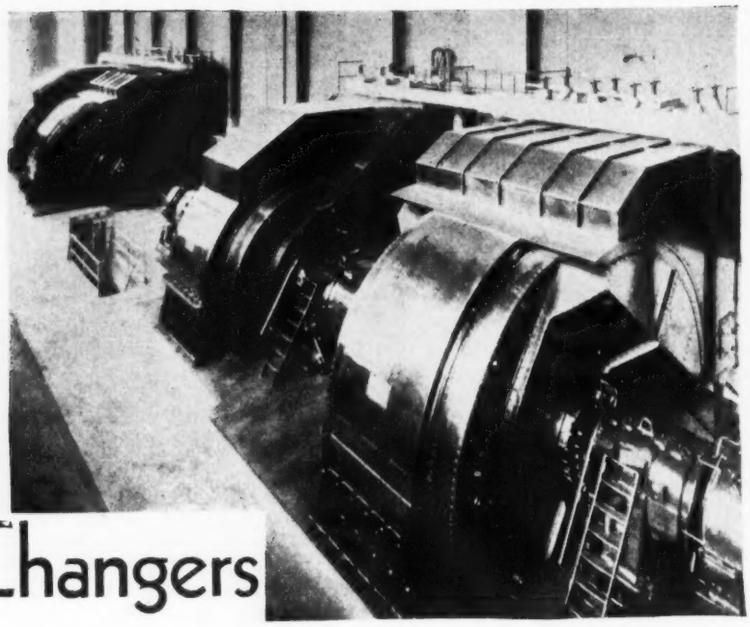
By the use of synchronous motor drive with dynamic braking for emergency stops it is possible to meet the requirements of rubber mill safety codes which specify a certain maximum travel allowable on the surface of the roll. In the event of an emergency, the operator pulls a safety bar above the rubber mill rolls, as shown in the accompanying illustration, thereby causing the tripping of a control switch. Opening of the control switch causes a main double throw contactor to drop open, disconnecting the motor from the line and simultaneously connecting the braking resistor across the armature terminals. After the motor has been brought to rest the field excitation is automatically removed by means of a definite time relay.

Bandsaws and steel mills have applications

Dynamic braking is also used to advantage in the lumber industry on synchronous motors driving bandsaws, which have a large amount of inertia and are therefore difficult to accelerate and to bring to a stop. The time required to accelerate a bandsaw to full speed is of the order of one minute, even with more than full-load accelerating torque. When no method of braking is employed for bringing the machine to rest the wheels continue to rotate for perhaps twenty minutes or more after the removal of power from the motor. Since it is necessary to shut down rather frequently to change saws, it is desirable to reduce the stopping time as much as possible in order to prevent unnecessary loss of production.

When synchronous motors are used and the control arranged for dynamic braking it is possible to bring the saw to a standstill in approximately the same time as required for acceleration; that is, about one minute. The control equipment used in this case is similar to that employed for rubber mill service, differing only in the timing relays and the larger capacity braking resistors.

Another application for dynamic braking on synchronous motors is on main roll drives in steel mills. These drives contain a large amount of stored energy when running, and if some means of braking were not provided the motor would coast for a long period of time after removal of power.



Frequency Changers Also Have Stability Limits

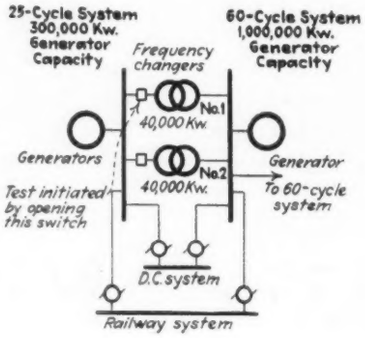
By T. G. LeCLAIR and A. J. KRUPY
Commonwealth Edison Company, Chicago, Ill.

OPERATING conditions indicated that the synchronous tie between the 25- and 60-cycle systems of the Commonwealth Edison Company might not remain stable under certain disturbances. This tie consists only of two 40,000-kw. synchronous frequency changers without any of the long high-voltage lines usually associated with stability problems. But in any stability problem the load limit is a function of the total circuit impedance, and this resides in rotating machines as well as in transformers and transmission lines. In the case discussed here the tie reactance is only the reactance of the machines, and yet unstable operation may result. The tests described did demonstrate that with both machines under full load the loss of one under fault would cause loss of synchronism between systems, although sudden removal of one machine without fault did not so result. It was also found that instability could be avoided under reasonable fault conditions by a simple scheme of high-speed excitation with a rate of response of about 300 volts per second.

When the first frequency changer was installed there was no stability problem, as this unit represented the largest single generating source of the 25-cycle system and normal provision for reserve would take care of its loss. When the second machine was installed the condition was altered materially. The load division between the generators of the interconnected alternating-current system is controlled by the governor settings on the prime movers and is not dependent upon the reactance of the interconnecting link. Regulation of all units, including the load division and voltage regulation, is non-automatic. For this reason, if two frequency changers are carrying full load and one is suddenly unloaded, say by opening one of the circuit breakers, the remaining machine would tend to pick up double load. Since the steady pull-out limit of one machine is 160 per cent of normal load, it could not stay in step with 200 per cent load imposed by opening of the switch. Conditions are even less favorable with short circuit than in the case of a sudden transfer of load because of the demagnetizing effect of the armature reaction which takes place during fault.

Testing simpler than calculating

An estimate of stability limits for the above conditions can be made analytically, but on account of the



Schematic diagram of system connections

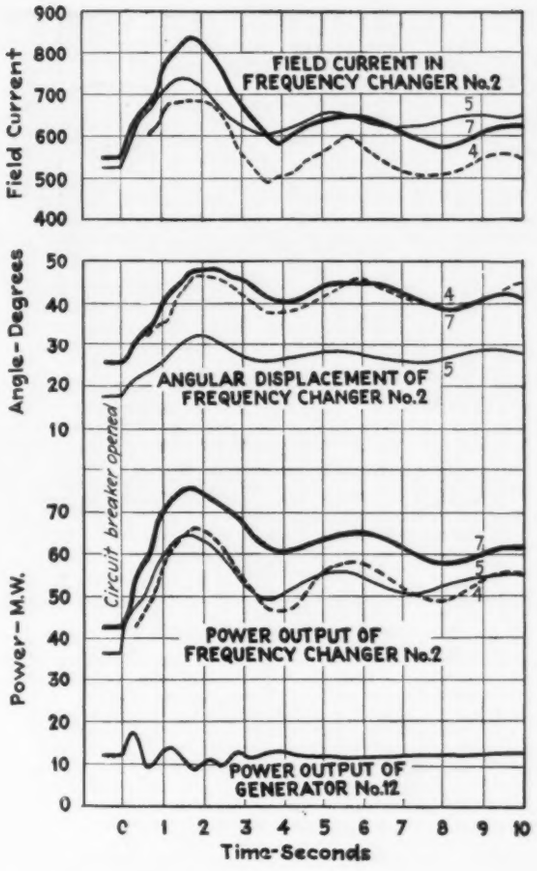
The frequency changer sets were designed for normal transfer of power from the 60-cycle system to the 25-cycle system. The 60-cycle synchronous motor is rated at 54,500 hp., 85 per cent power factor, for power-factor correction, while the 25-cycle generator is rated at 40,000 kw. unity power factor. This means that the excitation of the 25-cycle end of each machine is considerably lower than that of the 60-cycle end; therefore, if a loss of synchronism occurs between the systems, it will take place on the 25-cycle end.

Curves derived from oscillograms

The upper group of curves shows the variation of field current corresponding to power swings of the machine. Test 7 represents the heaviest initial loading, 80,000 kw., and during the first swing the field current increases from the normal excitation value, 560 amp., to about 850 amp. and gradually settles down to a new, intermediate value. The corresponding angular swing is shown on the second group of curves, while the power oscillation is shown on the lower group. The curves marked "5" and "4" are for identical initial loading of machines, but with and without high-speed excitation, respectively. The initial value of power swing does not seem to depend upon the method of excitation used, but the damping of power oscillation is much more rapid in case of high-speed excitation. It will also be seen that the corresponding angular displacement differs by 10-15 deg. This means that for the same power output of the machine the angular displacement, in case of high-speed excitation, is considerably smaller, indicating the stiffening effect due to increased field.

The curves also show another important point which the tests were expected to demonstrate. Even during the first swing the machine remaining on the system does not pick up all the load previously carried by the two machines. The load continues to drop during further oscillations even with high-speed excitation. This load is not lost, but is transferred from the 25-cycle to the 60-cycle system through converters feeding the 230-volt d.c. network and the 600-volt railway system. The equivalent resistance of this connection between the systems is so low that while the change in bus voltages was hardly measurable, it was sufficient to effect a transfer of 15,000-20,000 kw. from one system to the other.

The lowest curve indicates the oscillation in power output of one of the steam turbo-generators which was connected to the 25-cycle bus during the tests. The frequency of this power oscillation was considerably higher than that of the frequency changer, but there was no difference between the initial and final value of the generator output. The generator oscillations were practically damped out in about four seconds, while the frequency changer oscillation could be clearly distinguished for at least 15-20 seconds after tripping of the switch. The power swing through the frequency changer reached maximum in about 1.8 seconds. This time seemed to be fairly independent of the method of excitation used or the amount of initial loading on both machines. Calculations made on the basis of simplified system connections and constant value of transient reactance of machines indicated the corresponding time of about 1.3 seconds.



The slower swing in the actual system was most probably due to the shunting effect of the d.c. network connected to both 25-cycle and 60-cycle systems.

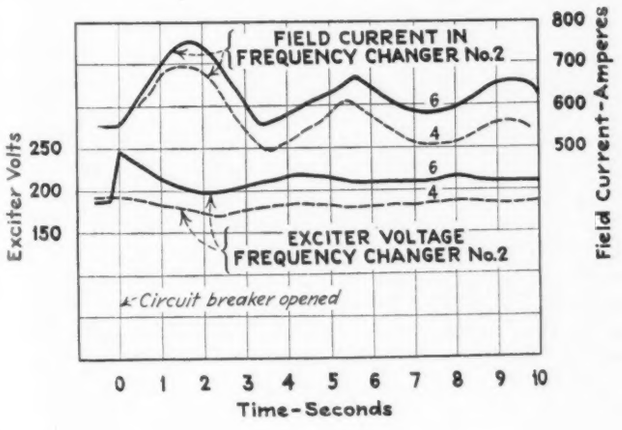
complicated operating connections and the necessity for many simplifying assumptions tests were made to determine the following:

1. The actual pull-out limit for individual machines as affected by system connections.

2. The effect of high-speed excitation on the stability limit for sudden change of load or switching under fault conditions.

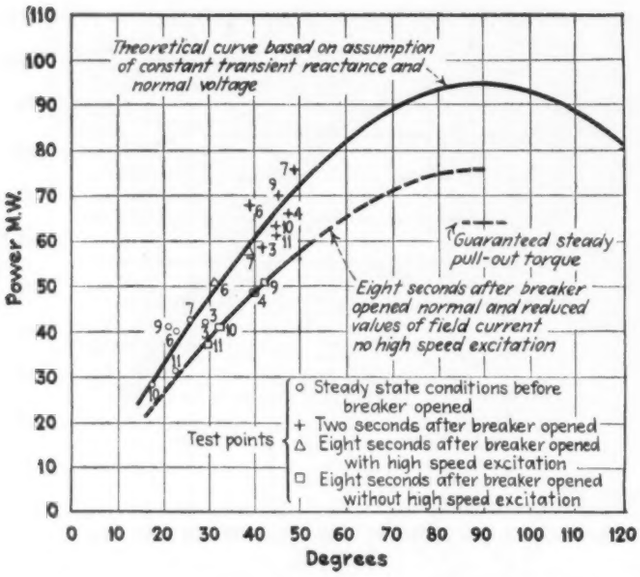
Tests were initiated by opening the 25-cycle breaker of frequency changer No. 1. Eleven tests were made, with various initial loads on the machines and different connections of the exciter field circuits. The electrical conditions of both the 25- and 60-cycle systems were recorded by oscillographs and other graphic meters and supplemented by visual observation and reading of indicating meters. Accurate measurements were made of the instantaneous power transfer over the frequency changers and the corresponding angular displacement between voltages of the 25-cycle machines and the 25-cycle bus to indicate whether the system had sufficient margin of stability.

The effect of high-speed excitation was tested by a comparatively simple set-up. The field circuit of machine exciters which is normally connected in series was reconnected in several parallel paths and simple relays provided to short circuit the external resistance during the test. This caused a rapid rise of exciter voltage and



Effect of high-speed excitation is marked

The graph shows clearly the effect of the high-speed excitation. The dotted lines (curve 4) indicate the exciter voltage of frequency changer No. 2 and the corresponding field current in the main machine while operating without high-speed excitation. Curves 6 represent exciter voltage and field current when the high-speed excitation was used. It will be observed that during 0.2 second, just previous to switching, the exciter voltage increased from 180 to about 250, which corresponds to a rate of voltage rise of about 310 volts per second. During the tests the exciter voltage did not remain constant, but dropped considerably. This voltage could probably be kept reasonably constant by appropriate regulators, which were not available for the test.


Theoretical curve based on assumption of constant transient reactance and normal voltage
Guaranteed steady pull-out torque
Eight seconds after breaker opened normal and reduced values of field current no high speed excitation
Test points
o Steady state conditions before breaker opened
+ Two seconds after breaker opened
△ Eight seconds after breaker opened with high speed excitation
□ Eight seconds after breaker opened without high speed excitation
Power M.W.
Degrees

Derived power-angle diagram for 25-cycle end of frequency changer

From a number of derived curves, prepared from original oscillograms, a composite power-angle diagram was made for frequency changer No. 2, operating between the 25- and 60-cycle systems. This diagram indicates the position of test points with respect to the theoretical curve. It will be noted that the points marked "6" and "7," which correspond to initial loading of 80,000 and 75,000 kw. respectively, do not deviate a great deal from the theoretical power-angle curve based on constant machine reactance. The test points marked 10, 11, 4, 9, etc., show definitely that there is a considerable increase in the effective value of machine reactance at the end of the eight-second period covered by the test if the high-speed excitation is not used. From the above, it appears certain that the scheme of high-speed excitation, as outlined, should be ample to keep the machine reactance nearly equal to transient value, thus insuring stability under operating conditions.

a corresponding increase of excitation in the machine. The initiation of this high-speed excitation was controlled by a cam switch arranged to close about 0.2 second previous to opening of the 25-cycle breaker on machine No. 1.

To measure the angular displacement of a given machine voltage with respect to another machine or to bus voltage an instantaneous power element of the oscillograph was used in conjunction with a pilot generator rigidly coupled to the machine. Wound-rotor induction motors of a suitable number of poles were used as pilot generators.

In addition to the two oscillographs used to obtain the records shown, two automatic oscillographs, equipped with three-phase average power galvanometers, were used to check the power input and output of the frequency changers. Using these oscillograms, derived curves were prepared giving directly the angles, instantaneous three-phase power and other electrical indications, from which it is easier to see the effect of initial loading upon the power swings and angular oscillations of the machines and thus to arrive at some conclusions as to the margin of stability. A set of such derived curves is reproduced here and from them it can be seen that the proposed scheme of high-speed excitation and the resultant strengthening of field are quite effective in increasing the maximum pull-out limit under operating conditions.

It should be noted, however, that the usual voltage regulator will not start the high-speed excitation. The generators on both the 25-cycle and 60-cycle systems of the Commonwealth Edison Company do not have automatic voltage regulation, but are provided with manual control only. The voltage variation on the bus of such a large system, even during severe faults, is not sufficient to offer positive means of rapid initiation of high-speed excitation when necessary. Opening of the switch on one of the machines, thus changing the effective reactance of transfer between the two systems, produces even smaller voltage change. Therefore, two separate schemes of initiating the high-speed excitation are to be used, as shown schematically.

Results of tests

The results of these tests are briefly summarized as follows:

1. Under normal conditions when the 25-cycle and 60-cycle systems are interconnected through two frequency changers, each carrying rated load of 40,000 kw. or less with normal excitation, instability will not occur as long as there is no fault. Sudden overloading of one machine, which may be caused by opening of switches on the other, will cause power swings, but the machine will still remain in step. Partial transfer of load through the direct-current system makes this condition possible.

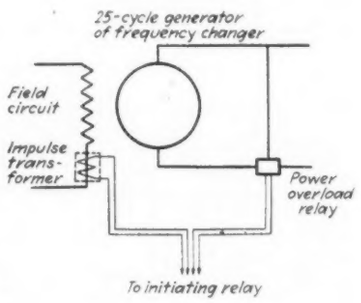
2. If a fault occurs on one of the machines while both are carrying load and normal excitation the systems will pull out of step after the fault is cleared. To compensate for the demagnetizing effect of the armature reaction on the field high-speed excitation is necessary.

3. A simple rearrangement of the field circuit connections of the present exciters and the installation of suitable relays give a rate of exciter response of about 300 volts per second. This rate of response is sufficient for the required strengthening of the field.

4. After the installation of high-speed excitation, as described, the margin of stability will be sufficient to permit loading of both frequency changers to full rating of 40,000 kw. each, with increased reliability of operation. The systems will stay in step, even after a two-phase-to-ground fault occurs on one machine, provided it is cleared within ½ second.

These tests serve as an illustration that stability problems may arise in the operation of any synchronous tie.

Methods of initiating high-speed excitation



To take care of sudden transfer of load or sudden overload of one machine a power type overload relay is used. When the load on one machine becomes larger than a previously set value, the relay closes the initiating contact for high-speed excitation and coincidentally operates the timing relay. If no manual adjustment is made in the meanwhile, the high-speed excitation is discontinued and connections restored to normal in about five minutes.

To provide the quickest possible response during fault conditions, the high-speed excitation is initiated by a special impulse transformer installed in the field circuit of the 25-cycle generator of the frequency changer. When a fault occurs the a.c. component in the field circuit induced by the fault current in the machine armature provides sufficient current to operate a closing relay and start the high-speed excitation.

whether or not transmission lines or transformers are involved. It will hold true whether the connection is all at one frequency or through directly connected synchronous machines at different frequencies. While stability limits may be estimated theoretically, the real answer, taking into account all the operating conditions, can best be obtained by an experimental check similar to that described in this article. It is sometimes possible to check the theoretical limits without actually testing to the pull-out value.

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Hydrogen Welding Now Automatically Controllable

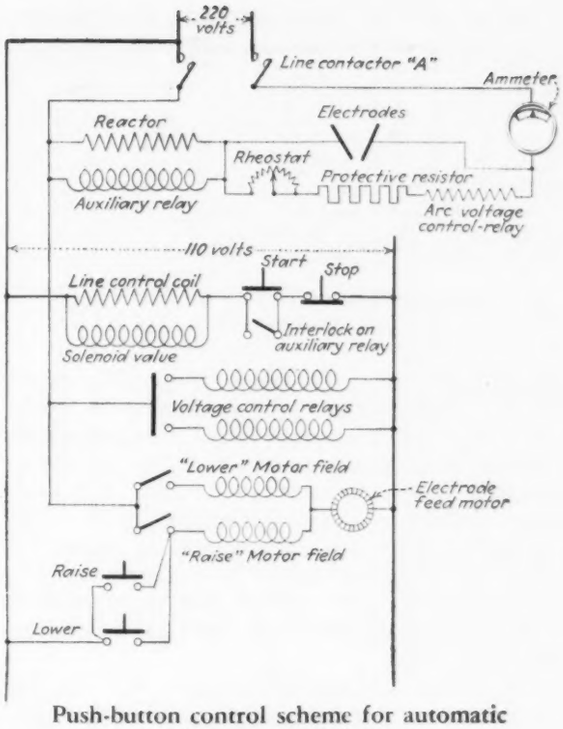
By S. MARTIN, Jr.
Industrial Engineering Department, General Electric Company, Schenectady, N. Y.

Atomic hydrogen welding is the utilizing of the heat of recombination of atomic hydrogen to form molecular hydrogen to fuse together similar or dissimilar metals. The atomic hydrogen is formed by the heat of an electric arc between two tungsten electrodes bathed in hydrogen. Molecular hydrogen blown into the arc displaces the atomic hydrogen, which then recombines and liberates heat which is available for welding. The atomic hydrogen forms a fan-shaped flame, the fringe of which is applied to the surfaces to be joined. In the hand-welding equipment the size and position of the flame are controlled by the operator by (1) manipulation of a lever on the electrode holder and (2) by the position of the electrode in respect to the work.

Therefore, welding automatically with the atomic hydrogen flame presents the problem of maintaining a definite size of flame in a fixed plane between two slowly consuming tungsten electrodes. The relation of the fringe of the flame and the work is fixed mechanically, a control system illustrated in the figure accomplishing this.

When the start button is pushed, the coil of the line contactor and the coil of the hydrogen solenoid valve are energized. These apply power to the electrodes through the reactor and turn on the hydrogen gas respectively. The electrodes are connected to opposite sides of the voltage regulator through a rheostat. Energizing of this relay results in the closing of contactors that cause the feed motor to feed the electrode down. "Lower" and "raise" contactors are opened and closed respectively, and the arc is started. After the arc is established the relay operates the electrode feed motor only at such times as the voltage across the arc increases or decreases. Because of the slow consumption of the tungsten electrodes the feed motor operates at intervals which may be seconds or minutes apart. The rheostat in the relay coil circuit controls the length of the arc and the reactor controls the arc current.

For hand operation, while making adjustments, push buttons are furnished on the panel for starting and stopping the equipment, for raising and lowering the tungsten electrodes and for starting and stopping the travel carriage. The plane of the flame is fixed at right angles to the plane of the electrodes by a slight offset of the electrodes.



Push-button control scheme for automatic hydrogen welding

Thus, the action of a single push button is sufficient to set in motion the train of events to the establishing and maintaining of an atomic hydrogen welding flame in a fixed plane.

Interlocked with the arc control is the travel carriage and filler wire control. When the arc is established, the travel carriage starts to move and the filler wire is fed into the arc.

It can therefore be arranged that, after the parts to be welded are in place, the action of a single push button will start the arc, add any necessary filler wire and cause the arc to move along the seam, thereby welding it. The action of another push button will stop all of these functions.

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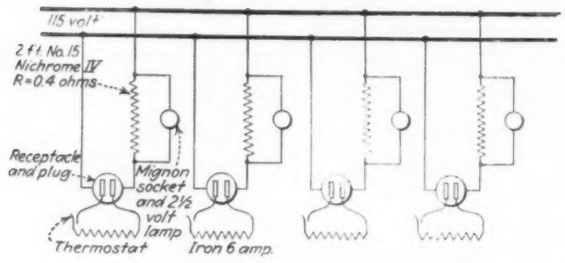
Finding the Fluttering Thermostat

By JOHN W. SPEAKER
Milwaukee, Wis.

Automatic electric irons particularly, and sometimes other thermostat-controlled household heating devices, are frequent sources of radio interference, so much so in fact that this consideration may in some cases prevent their sale. The interference is caused by a fluttering of the thermostat contact at the critical temperature point. Also the fluttering definitely shortens the life of the contact. The condition can be remedied only by proper contact design and can be prevented in service only by close inspection of the finished product before it leaves the factory. A simple means of factory inspection has been devised by the writer which can be used as well by radio interference hunters and by appliance repair men.

The means consists of introducing a resistance calculated for a drop of 2½ volts into the circuit. Across this



Automatic irons factory-checked for fluttering contacts

resistance is connected a flashlight lamp. The operation of the thermostat under check is thus made visible by the performance of the lamp. If it flashes intermittently the contact is defective and if it lights and goes out cleanly and sharply the contact is O.K. For multiple checking of automatic irons in the factory the circuit is set up with the materials and values as shown in the drawing. It is a simple matter to revise the values and the assembly of parts to make a portable outfit that can be used in checking irons and other heating devices in service.

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READERS' FORUM

Impressions of Illumination Congress

To the Editor of the ELECTRICAL WORLD:

Preceding the plenary sessions of the Congress at Cambridge the members of the Congress toured England and Scotland from September 1 to 13. During this tour, at which stops were made in Glasgow, Edinburgh, Sheffield and Birmingham, more than one hundred technical papers were presented. Many excellent papers were on the program, but the majority of papers could scarcely be viewed by a United States delegate as being of "international" quality or scope. These sessions suffered from the common malady of technical conventions —too many papers and parallel sessions. If such international meetings are to be of maximum value the programs might be simplified and improved by devoting sessions to subjects rather than to individual papers. Of course, a paper which contains really new and far-reaching data could be used to introduce the subject, but the remainder of the particular session could be devoted to discussions of the subject.

International meetings as well as national conventions are of value in renewing and making new personal acquaintances and in the informal discussions on the side lines. However, if international meetings are to be worth the cost in time and travel to the delegates and to the countries which they represent the programs must be arranged with "international" scope and interest in mind.

No delegate can complain of the solicitude shown by the British committees on arrangements. An enormous amount of detail was arranged by the untiring committees and local members. Entertainment and sightseeing were adequately provided for all, even those with only 24 hours at their disposal daily. The task of the British hosts was made additionally difficult by the generally inadequate and somewhat low-grade hotel facilities, as measured, at least, by the United States delegates, who are used to the comforts of baths and heating plants.

The tour included visits to industrial plants as well as inspection of street-lighting and floodlighting in the various cities. After the departure from London, the mixture of old and new was even more impressed upon the delegates. The British Isles has barely begun to see ideals in lighting of streets, industries and other places. In industrial Glasgow, Sheffield and Birmingham conditions were admitted to be pitiful even by local delegates. Courageous efforts are being made by local lighting companies to improve industrial lighting, but traditional backwardness seems to be a severe brake on progress.

In street lighting occasional installations begin to approach our better lighting, but not our best. Very valiant efforts were made in floodlighting, considering the disheartening dirtiness of the buildings in Glasgow, Edinburgh, Sheffield and Birmingham.

Edinburgh Castle was a fairyland indeed. Large, rambling, old and historic, its rests majestically upon a precipitous height, as a castle should. Seen against the black sky and black foundation it appeared like many doll houses. Again through the mist its highlights and shadows brought to mind its romantic and tragic happenings of nearly ten centuries of history. Indeed, it afforded the finest subject for floodlighting that one might hope for, and Edinburgh itself delighted in this new view. Of course, tradition and conservatism could not remain totally subdued. Some newspaper comments hinted at desecration. The old is still tyrannically opposing the new.

In the discussion of papers the radical differences in the problems and viewpoints confronting various nations were quite obvious. It is difficult for a United States delegate, used to his vertically built cities, to adjust himself to the English viewpoint based upon cities built horizontally. The United States delegate could scarcely be more than lukewarm in his interest in daylight, which to the Londoner is important. The local delegates think in terms of the ancient Roman laws pertaining to daylight rights. Likewise, it must have been at least mildly astonishing to the United States delegates to see so many gas-lighting papers on the programs. Those who recalled when gas-lighting was making its last, though creditable, stand in the United States heard many of the same arguments in favor of gas, such as its contribution to the ventilation and heating of the rooms.

Perhaps one may say that the best lighting practice and thinking exhibited by the installations and papers respectively are approximately equivalent to United States standards. However, by and large, there seems to be a much greater prevalence of lower grade practice and thinking than in the United States, admitting that our country is generally in the primitive stage of modern lighting.

Too much praise can scarcely be given the British committees for the arrangements they made for the success of the tour. The only possible criticism is that toward the quantity of papers and the quality of many of them. The latter might well be presented at local meetings in the countries in which they originated, but they could scarcely be acceptable for international programs.

The final business of the I.I.C. will be transacted in the plenary sessions in Cambridge, September 14-19.

A U. S. DELEGATE.

Men of the Industry

J. H. Trumbull New President of N.E.M.A.

JOHN H. TRUMBULL, president of the Trumbull Electric Manufacturing Company since 1900 and a former Governor of the State of Connecticut, was elected president of the National Electrical Manufacturers' Association at the convention held last week in New York. For ten years Mr. Trumbull has been a dominant personality in political circles in Connecticut, having served for two terms (1921-1925) as State Senator and for three terms as Governor (1925-1931). During this period of political activity Mr. Trumbull remained in close contact with the electrical manufacturing industry, directing the Trumbull Electric Manufacturing Company as chief executive and devoting his attention unstintingly to the affairs of the association which he has just been selected to head.

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C. E. BRENTON, for the past eight years general manager of the Southeast Missouri district of the Missouri Utilities Company, has resigned his position with that company to join the Union Electric Light & Power Company of St. Louis in a similar capacity.

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WILLIAM SCHEERER, chairman of the board of the Fidelity Union Trust Company, has been appointed to the executive committee of the Public Service Corporation of New Jersey. Mr. Scheerer has been a director of the corporation for some time.

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P. J. PYBUS, chairman of the Power & Traction Finance Company and a director of the English Electric Company, both prominent British electrical undertakings, is Britain's new Transport Minister in the national government. Mr. Pybus is a Liberal member of Parliament. He has served on a number of royal commissions and public committees, among them the royal commissions on the Civil Service, the Development Advisory Committee and the Committee on Industry and Trade.

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JOSEPH PODOSKI, secretary-general of the Polish Association of Electrical Engineers, has recently been touring the eastern section of the United States in the interests of his organization. Mr. Podoski spent considerable time acquainting himself with the policies and operating procedure of the American Institute of Electrical Engineers and the American Standards Association. He was interested also in electric power problems and railway electrification, spending several days visiting manufacturing plants and operating properties in an effort to gain a first-hand impression of American practices.

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A. V. Guillou Joins Wisconsin Commission

A. V. GUILLOU, for the past 4½ years assistant chief engineer for the California Railroad Commission, has resigned to become chief engineer of the newly reorganized Public Service Commission of Wisconsin. Prior to his

connection with the California commission, Mr. Guillou was associated with a number of California power companies. After his graduation from the University of California with the class of 1912, he spent two years with the Westinghouse Electric & Manufacturing Company in East Pittsburgh and then joined as commercial salesman the Pacific Light & Power Corporation, later merged with the Southern California Edison Company. Subsequently he became district manager for the Mount Whitney Power & Electric Company. When that company was taken over by the Edison company in 1919 Mr. Guillou joined its engineering department, but left in April of 1920 to become affiliated with the California Railroad Commission as assistant engineer. Three years later he was appointed gas and electrical engineer, and after four years was made assistant chief engineer. During 4½ years in the latter position he has had an active part in a number of condemnation cases coming before the Railroad Commission.

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THOMAS N. MCCARTER, president of the Public Service Corporation of New Jersey, has been appointed chairman of the executive committee of the Fidelity Union Trust Company, Newark, N. J.

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C. A. ELLIOTT, for the last eleven years manager of the municipally owned light and water systems of San Augustine, Tex., tendered his resignation to the City Council September 5, effective immediately. Ill health was the reason for Mr. Elliott's resignation. G. C. Mitchell, member of City Council and an electrician, will be in charge until the successor of Mr. Elliott is named.

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C. L. DAWES, formerly assistant professor of electrical engineering at Harvard University, has been advanced to associate professor. Mr. Dawes is known especially for his research work in the insulation field, contributing extensively on this subject to technical literature. He has served on the cable research committee of the National Electric Light Association and also on the American Institute of Electrical Engineers committee on dielectrics and sub-committee on definitions and terminology. Mr. Dawes is also a member of the National Research Council.

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EDWARD W. MOREHOUSE, professor of economics at Northwestern University, has been appointed head of a newly organized department of rates and research for the Wisconsin Public Service Commission. Mr. Morehouse was assistant to Prof. John R. Commons at the University of Wisconsin, removing to Madison in 1919 as a graduate student in economics. He received his Ph.D. degree in economics in 1927. Prior to and since that time he has been teaching public utility economics and doing research in that field.

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H. H. BARNES, JR., a vice-president of the General Electric Company, has been appointed a divisional chairman of the commerce and industry division of the Emergency Unemployment Relief Committee, it was announced recently by Harvey D. Gibson, chairman of the committee. Mr. Barnes will head the activities of the electrical industries in

the division. The Emergency Unemployment Relief Committee has been organized by business leaders to provide unemployment relief in New York this winter. Plans for co-ordinating the task of raising and distributing funds in all five boroughs of the city have been announced. Mr. Barnes will form a committee to conduct solicitation among individuals and corporations in the electrical industries.

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SAMUEL H. ABBEY, formerly assistant manager of the electric department of the Northern New York Utilities, Inc., has been named acting general manager of the company, succeeding Herbert G. Davis, formerly vice-president and general manager, who retired September 1. Mr. Abbey was notified of his promotion on September 11 and assumed his new duties immediately. Since Mr. Davis resigned Mr. Abbey has been taking over his immediate duties. For the past eight years Mr. Abbey has been associated with the Northern New York Utilities, Inc., as assistant to Mr. Davis. He was formerly with the General Electric Company at Schenectady, N. Y.

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T. C. MCFARLAND, who for the past year has been doing special work in engineering at the Bell Telephone Laboratories, Inc., New York, has returned to Berkeley, Cal., to resume his duties as associate professor of electrical engineering at the University of California.

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OBITUARY

JOHN H. HUNT, since 1904 purchasing agent for the Pacific Gas & Electric Company, San Francisco, and its predecessor companies, died of heart failure September 13 while swimming in Bolinas Bay, California.

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FRANK G. CURTIS, electrical engineer and inventor, died September 10 in Jacksonville, Fla., after a brief illness. He had been a resident of Jacksonville since 1920, although he spent considerable time in New York and Baltimore, where he retained business connections. Mr. Curtis was born in Chicago, but removing to the East, he conducted an electrical business in New York. He had to his credit the development of several electrical inventions.

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A. D. QUINN, sales manager of the industrial division of the L. H. Gilmer Company, manufacturer of molded rubber belts, with offices in Philadelphia, Pa., died suddenly, September 17, in Chicago while on a business trip. Mr. Quinn became associated with the Gilmer Company in 1919 and three years later was placed in charge of the sales of the industrial division.

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NATHAN T. PULSIFER, formerly president of Valentine & Company, varnish manufacturers, and prominently identified with various industrial enterprises in New England, died September 9 at his home in Orange County, New York, in his eightieth year. Mr. Pulsifer was born in Waltham, Mass., and started business with woolen merchants in Boston. Later he became managing owner of the Oakland Paper Company of Manchester, Conn., and while in that city organized the Manchester Light & Power Company and the Mather Electro Company, makers of electric lamps and dynamos. He resigned from the chairmanship of the board of Valentine & Company in 1930. At the time of his death he was a director of the Bon-Ami Company, Houghton, Mifflin & Company and the Technicolor Company.

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WILLIAM HENRY WATTIS, president of the Six Companies, Inc., which holds the contract for the construction of Hoover Dam, died in San Francisco September 13, after a long illness. Born on a farm not far from Ogden, Utah, Mr. Wattis entered the contracting business when he was a very young man, and he and his brother, E. O. Wattis, were associated in this work nearly all their lives. They built the Union Pacific Railroad from Salt Lake City to the California State line as one of their first big jobs. In 1900 the Utah Construction Company was organized and William H. Wattis became president. This company did the excavation work for the O'Shaughnessy Dam on San Francisco's Hetch Hetchy water project and for the American Falls Dam, built by the Department of the Interior in Idaho, two of the largest dams in the world.

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G. H. FINKS, power sales engineer for the Alabama Power Company, died at his Birmingham residence September 18, of pneumonia. Mr. Finks was born at Bertha, Va., and was graduated from Virginia Polytechnic Institute in electrical engineering. He at once entered the employ of the Norfolk & Western Railroad, working at the Roanoke shops and other places in the system. Later the Gilliam Coal & Coke Company, Gilliam, W. Va., placed him in charge of all its electrical work, which position he held until he joined the United States govenment forces at Hog Island Shipyard. From Hog Island he was transferred to the aviation department of the government at League Island. Shortly after the close of the World War Mr. Finks became connected with the Mill & Mine Engineers, Birmingham, entering the employ of the Alabama Power Company in 1922 as power engineer with the sales department.

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S. E. DICKINSON, 60 years old, superintendent of the municipal light plant at Kendallville, Ind., died in a hospital recently following a stroke of apoplexy. He had been connected with the lighting plant since 1896, serving first as an engineer, subsequently being made superintendent.

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OLIVER J. BUSHNELL, superintendent of the meter department of the Commonwealth Edison Company, Chicago, died recently at his home in Hinsdale in his sixtieth year. Mr. Bushnell had been identified with the Commonwealth Edison Company and its predecessor, the Chicago Edison Company, since 1892 and had held the position of superintendent of the meter department for almost 35 years. Throughout his career he had been keenly interested in new developments and improvements in meters and metering practices. While chairman of the meter committee of the National Electric Light Association he edited and directed the preparation of the first edition of the Handbook for Electrical Metermen. Mr. Bushnell was a past-chairman of the committee on metering and service methods of the Association of Edison Illuminating Companies and had recently been appointed a member of the committee of advisers on measuring instruments of the United States national committee of the International Electrotechnical Commission.

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ROBERT S. CAMPBELL, a prominent figure in the electrical industry 30 years ago in Salt Lake City, died at his home in that city September 5 at the age of 76 years. Mr. Campbell was born in Salt Lake City in 1854 and secured his electrical engineering education at the University of Utah, which in the earlier days was known as the University of Deseret. In 1873 he entered the employ of the Utah Northern Railway, at Logan, Utah, and later was elected Mayor of that city, in which capacity he served two terms. For a number of years he was engaged in the mercantile business, following which he became manager of the Utah Light & Power Company, with supervision also over the street railway system in Salt Lake City. This company was one of the predecessors of the present Utah Power & Light Company. In 1906 he negotiated the sale of the old company to the E. H. Harriman interests. Mr. Campbell took a prominent part in the civic and business life of his native city.

Financial and Statistical News

TWO trends of major significance point to strong buyer support in the bond market. One is an apparent disposition of investment bankers to stand behind listed issues through buying pools, one of which is already said to have been formed. The other trend is in favor of liberalizing savings bank investment laws in certain states for the purchase of utility securities.

——BOND MARKET SUPPORT IS REGARDED AS ESPECIALLY IMPORTANT at this time, since initial signs of reviving confidence are usually sought in the bond rather than in the stock market. Consensus of opinion of bankers consulted about British action on sterling is that a necessary and belated operation has been performed and that possibilities of recovery, both here and abroad, have been advanced materially by the action.

——AVERAGE OF 37 UTILITY COMMON STOCKS reached a new low for the year of 47.9, against 54.2 last week and a high for the year of 74. Sharp breaks occurred in several issues before the recovery set in.

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Rate Reductions Effect Savings

AN APPROXIMATE SAVING of more than $280,000 annually would be made by customers of the operating subsidiaries of the Central & South West Utilities Company as a result of electric rate reductions placed in effect during the first eight months of this year alone. Approximately $2,000,000 has been saved in a cumulative fashion by residential customers alone as a result of rate reductions effected since January, 1928. Commercial lighting and power rates have paralleled residential rates in the downward trend, it was pointed out.

Evidence that rate reductions increase rather than decrease revenues is shown in the fact that, in spite of reductions made every year throughout the territory, the average revenue per residential customer, for example, has gained more than 7.6 per cent in the past two years.

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Power Corporation of Canada Issues Year Book

THE RECENTLY ISSUED STATEMENT of the operations of the public utility companies which the Power Corporation of Canada controls or is substantially interested in is indicative not only of the breadth of the corporation's operations but of consistent rapid expansion. The statement discloses that between 1926 and 1931 the total kilowatt-hours generated yearly rose by 60 per cent and the total plant capacity by 78 per cent.

Undeveloped power sites in control of affiliated companies at the end of the last fiscal year had a total capacity of 1,227,450 hp., and the total ultimate capacity of all plants was 2,039,450 hp., or virtually three times present installation. The manner in which the corporation enters into the life of the Dominion today in various phases is illustrated in the fact that the total population of territories served by controlled or affiliated companies is about 1,300,000 and there are 260,000 direct consumers.

Weekly Output Rises Slightly

OUTPUT OF ELECTRIC light and power plants continues to run somewhat under that of the past two years, according to estimates published by the National Electric Light Association, although the usual autumn rise is bringing an increase over August operations.

During the first three weeks in September production averaged about 4 per cent lower than in 1930. The decrease in weekly output caused by Labor Day is evident in the following table covering recent weeks and corresponding weeks in earlier years.

	1931	1930	1929	1928
August 15	1,629	1,677	1,733	1,567
August 22	1,643	1,691	1,759	1,576
August 29	1,638	1,688	1,762	1,586
September 5	1,636	1,630	1,675	1,484
September 12	1,582	1,727	1,806	1,604
September 19	1,663	1,722	1,792	1,614

Regional declines compared with 1930 were general in the two-week period ended September 12, and were somewhat larger than in August. There was a decrease of 1 per cent on the Atlantic seaboard, 6.5 per cent in the central industrial region, though only 4.2 per cent in the Chicago district alone, and 4.3 per cent on the Pacific Coast.

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Broad Market Seen for Utility Securities

WHILE the volume of new flotations in the utility field has exceeded that of any other single group, demand is reported by dealers to bear a satisfactory relation to supply. High-grade issues have been quickly disposed of when offered.

One of the largest sources of demand for high-grade utility securities arises out of replacement of railroad issues, which have ceased to share the favor of buyers for insurance companies and savings banks or have ceased to be eligible for the latter. This institutional demand is expected to increase with the general improvement in conditions. One authority estimates that these two classes of institution, along with commercial banks and trustees, will absorb close to a quarter billion dollars yearly. Legal restrictions on the purchase of these securities by mutual savings banks are expected to be broadened in the near future. This is suggested especially by the restricted number of railroad issues likely to remain on the legal lists in the future. Discussing this subject recently, E. A. MacNutt, treasurer of the Sun Life Assurance Company, Canada, one of the world's outstanding institutional investors, predicted that unless business improves considerably by the end of the present year 75 per cent of all railroad bonds will lose their legal standing as investments for savings banks and insurance companies. Mr. MacNutt added:

The earnings have been greatly reduced by motor truck competition and this competition will not end with the passing of the depression. In addition, the railroads have hundreds of millions of bond issues nearing maturity. Who is going to buy them if the issues are illegal for insurance companies and savings banks? In the present depression public utility companies have suffered least. Their net income shows only a slight decrease in comparison with other corporations. It is estimated that in the next ten years there will be a

90 per cent increase in the consumption of electricity. Thirty per cent of the Sun Life assets are invested in public utility bonds and stocks.

Despite the unhealthy business situation, there are certain definite factors in favor of the bond market at the moment. Halsey, Stuart & Company in a current letter point to the unusually low levels of money rates and the fact that business activity has left a great deal of money free for investment which in ordinary times would be required in the conduct of business. The supply of fixed-income bearing obligations, they point out, has been added to only moderately, and because of the extremely conservative attitude adopted by the majority of investors new bond offerings have consisted almost entirely of issues combining security and liquidity to a high degree. Relative to utility bonds, the market letter points out that these are especially favored as a result of stability of earnings in the face of severe business depression.

Keep standards high

From the utility standpoint every effort will be made so to conduct their affairs that the securities will continue to be suitable for institutional investment. M. S. Sloan, president of the New York Edison Company, told the New York Savings Bank Association last week. Mr. Sloan, quoted elsewhere in this issue, drew a parallel between the senior securities of the utilities today and those of the carriers two decades ago.

Discussing the same question recently in the *Public Utilities Fortnightly*, F. J. Lisman, New York investment banker, emphasized the urgency of keeping the standards high as a credit safeguard. Mr. Lisman is quoted as saying:

Everything in business changes at a more rapid rate than ever before; obviously, therefore, obsolescence is progressing at a correspondingly more rapid rate.

What is the value of and where are the primitive power plants of 50 or even 25 years ago?

The cost of producing power by coal is being steadily reduced; it is in most cases now cheaper than water power, except in locations where coal has to be brought long distances.

Who knows about the future methods of costs of generating power? Hundreds of minds are concentrated on the economical extraction of power direct from sunbeams, the source of all power on our planet. If this theory could ever be developed commercially it would change the industrial picture very substantially. Many other changes now not dreamed of are in the range of possibility. If the investor is really to be protected, therefore, every security issue should have a sinking fund.

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July Earnings Over Last Year's

REVENUE of electric light and power companies, unlike that of most other branches of industry, continues month by month at virtually the level of 1929 and 1930. The showing in July was even better. The total revenue estimated on the basis of returns thus far received by the ELECTRICAL WORLD for 80 per cent of the industry amounted to $167,190,000, against $166,200,000 in 1930 and $162,300,000 in 1929. This makes them the largest July earnings in the history of the industry, by a margin of 0.6 per cent. The total is smaller than it was in June, as is usually the case.

Operating expenses were 3 per cent less than a year ago, with the result of a $3,300,000 increase in net. Energy output, approaching 7,225,000,000 kw.-hr., was greater than in June and came closest of any month this year to operations in 1930, which it missed by only 1.8 per cent. Output from water power was less, but from fuel more, than in June. Details appear in Table III. Except as to natural gas, fuel consumption was materially less than last year. Comparison of Tables II and III reveals progressively improved efficiency in steam plants.

Compared with the gain during normal times of 7 or 8 per cent annually, the revenue increase of 3 per cent in two years is small, but contrasted with the recessions in various important branches of manufacture it is conspicuously large. The figures here given are for energy revenue from all sources, including intercompany sales for resale, and hence comparable with the total revenue for

Eastern gains increasing, Mid-West losses shrinking

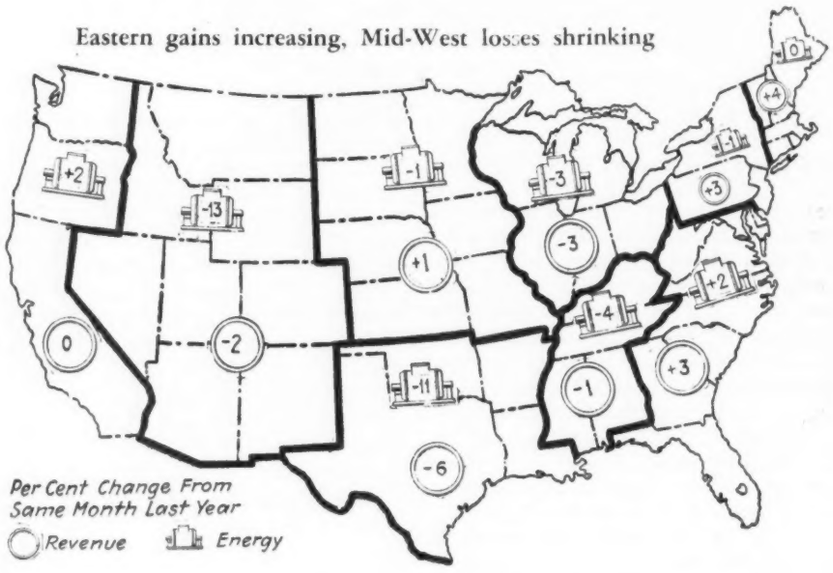


Table I—Central-Station Financial Operations in the United States

Compared with Corresponding Month of Previous Year

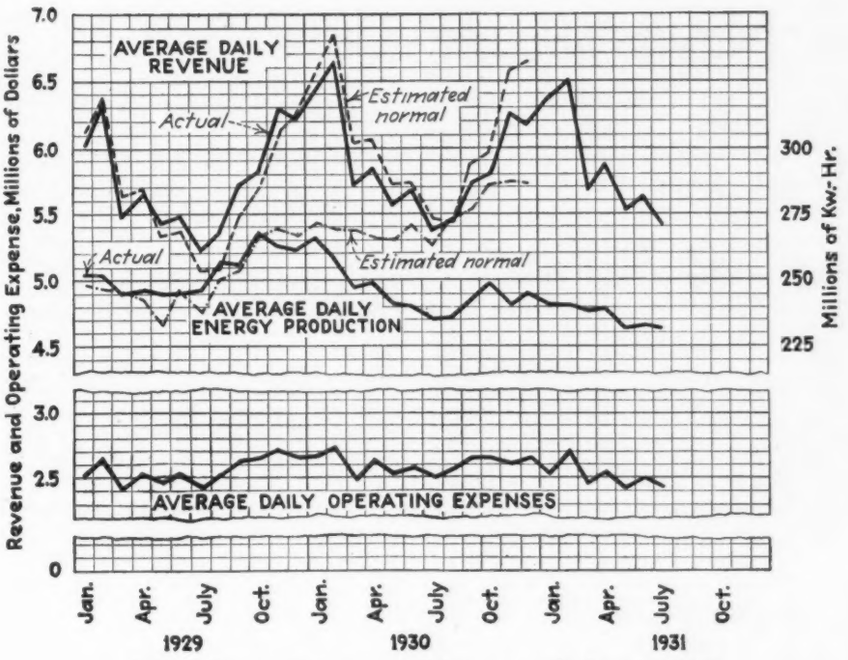
Month	Total Gross Revenue from Sale of Energy*			Total Operating and Maintenance Expense†		
	1931 Thousands	1930 Thousands	Per Cent Inc.	1931 Thousands	1930 Thousands	Per Cent Inc.
April	$176,210	$176,110	+0.1	$75,880	$78,300	—3.1
May	171,550	172,900	—0.8	74,560	77,900	—4.3
June	168,510	170,200	—1.0	74,340	76,400	—2.7
July	167,190	166,200	+0.6	75,170	77,500	—3.0

Table II—Central-Station Fuel Consumption in the United States‡

Compared with Corresponding Month of Previous Year

Month 1931	Coal		Oil		Gas	
	Short Tons	Per Cent Increase	Barrels	Per Cent Increase	Thousands Cubic Feet	Per Cent Increase
April	2,713,378	— 9.3	530,986	— 9.8	9,607,900	+ 0.8
May	2,703,414	—10.9	532,820	—10.0	9,889,055	+ 3.8
June	2,712,706	— 8.1	613,026	+ 0.4	11,545,332	+17.1
July	2,896,777	— 9.5	703,604	— 1.1	12,595,233	+20.4

*Aggregate gross revenue from consumers and from other utilities for energy for resale, involving a certain amount of duplication.
†Do not include interest, taxes, depreciation or sinking fund, with some unavoidable exceptions. ‡As collected by the U. S. Geological Survey.



July daily earnings nearer February peak than in 1929

electric service reported in the United States Census of the industry for the year 1927, as $1,802,655,493, or a monthly average of about $150,000,000.

Almost every part of the country participated in the upward movement in revenue, as compared with July, 1930. The entire Eastern seaboard, consisting of three geographical divisions, shows earnings that not only exceeded last year's, but exceeded them by a wider margin than in June. The industrial Middle West, down nearly 5 per cent in the previous month, cut the deficiency to less than 3 per cent. Only the two South Central sections fell back slightly.

Compared with June figures, incorporating slight revisions from those published in the issue of August 22, the entire Western group increased their revenue; the declines were chiefly in the Middle Atlantic and East North Central divisions—2.1 per cent and 2.7 per cent respectively—and were not abnormal for the season. Table IV shows in greater detail the changes in revenue and energy output compared with last year.

Table III—Energy Output of Central Stations in the United States

Compared with Corresponding Month of Previous Year

Month 1931	Generated, Thousands of Kw.-Hr.*						Purchased for Resale	
	Total		Hydro		Fuel			
	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Thous. Kw.-Hr.	Per Cent Inc.
April	7,189,134	—4.5	2,947,019	—4.8	4,242,115	—4.3	1,864,000	+9.0
May	7,191,717	—4.7	2,964,720	—1.1	4,226,997	—7.0	1,862,000	+6.5
June	7,004,935	—3.3	2,637,615	—5.5	4,367,320	—1.9	1,901,000	+5.8
July	7,224,762	—1.8	2,500,035	—4.4	4,724,727	—0.4	1,950,000	+7.0

Table IV—Regional Operations, Revenue and Energy Output in July, 1931

Compared with Corresponding Month of Previous Year

Region	Revenue		Energy Generated, Thousands of Kw.-Hr.*					
			Total		Hydro		Fuel	
	Thousands of Dollars	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.
United States	167,190	+0.6	7,224,762	— 1.8	2,500,035	— 4.4	4,724,727	— 0.4
New England	16,650	+4.1	446,777	0	193,580	+22.0	253,197	—12.1
Middle Atlantic	42,240	+2.7	1,734,964	— 1.0	445,777	+ 6.3	1,289,187	— 3.2
East North Central	39,570	—2.8	1,635,499	— 3.1	120,700	—14.0	1,514,799	— 2.1
West North Central	14,220	+1.2	493,567	— 1.1	110,389	—12.6	383,178	+ 2.8
South Atlantic	18,480	+2.9	822,398	+ 2.4	417,734	+22.2	404,664	—12.2
East South Central	5,700	—0.7	270,416	— 4.4	205,575	— 1.1	64,841	—13.6
West South Central	9,330	—5.8	412,730	—10.8	4,975	+84.0	407,755	—11.3
Mountain	4,200	—1.7	276,406	—13.3	236,167	—13.3	40,239	—13.1
Pacific	16,800	+0.4	1,132,005	+ 2.3	765,138	—19.0	366,867	+127.3

*By courtesy of U. S. Geological Survey, with deductions for operations not regarded as central-station operations.

Britain Generating More Current

THE OFFICIAL RETURNS just rendered to the British Electricity Commission show that 758,000,000 kw.-hr. was generated by authorized undertakers in Britain during the month of August, 1931, as compared with the finally revised figure of 721,000,000 kw.-hr. in the corresponding month of 1930, an increase of 5.1 per cent.

During the first eight months of 1931 up to the end of August the total generated by authorized undertakers was 7,173,000,000 kw.-hr., as compared with the finally revised figure of 6,928,000,000 kw.-hr. for the corresponding period of 1930, an increase of 3.5 per cent.

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NEWS BRIEFS

Directors of the Central Vermont Public Service Corporation have declared a dividend of $1, compared with $1.50 paid previously on common stock.

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Shawinigan Water & Power Company has declared a quarterly dividend of 50 cents, compared with 62½ cents paid previously on common stock.

•

All of the outstanding first mortgage gold bonds, series F, 5½ per cent, of the West Penn Power Company have been called for payment October 1 at 105 and interest.

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Additional class A stock, numbering 16,922 shares, of the International Hydro-Electric System has been authorized for listing on the New York Stock Exchange, on official notice of issuance as a stock dividend of 2 per cent, making the total amount applied for 1,645,274 shares. There have also been authorized for listing on the big board additional general and refunding mortgage gold bonds, series D, of the Detroit Edison Company, totaling $15,016,000. These 4½ per cent bonds mature February 1, 1961.

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American Commonwealths Power Corporation of New Jersey has declared in advance three monthly dividends on its $6.24 dividend series prior preferred stock, sold to customers. The first payment will be the initial dividend. This company has just been organized by the American Commonwealths Power Corporation of Delaware. The dividends of 52 cents each will be payable on October 1, November 1 and December 1, to stockholders of record on the twelfth day of the preceding months. The dividends are cumulative.

Business News and Markets

N.E.M.A. Units Work for Standards and Activity

APART from the annual dinner of the National Electrical Manufacturers' Association, at which Gerard Swope presented his plan for industrial stabilization, as reported last week, the New York convention of the association, held September 16 to 18 inclusive, was, as usual, of the hard-working and executive rather than the spectacular, attention-compelling type. The attendance, estimated at 400, was excellent, and the accomplishments of the 59 sectional, group and committee meetings will prove an aid both to standardization and other production problems and to business promotion. The refrigeration division completed a heavy program which will be reported on later. The motor and generator section devoted the greater part of its time to problems in connection with business development. The board of governors approved an action of the standards committee authorizing member companies to list, offer for sale and advertise products as being in conformity with N.E.M.A. standards after the date on which approval is given by the standards and codes committee.

New officers were elected as follows: President, John H. Trumbull, president Trumbull Electric Manufacturing Company; first vice-president, D. R. Bullen; second vice-president, W. E. Sprackling; third vice-president, F. R. Fishback; fourth vice-president, C. H. Strawbridge; fifth vice-president, S. L. Nicholson; treasurer, R. H. Goodwillie.

New members of the board of governors follow, those whose names are preceded by an asterisk being members of the executive committee:

From Section Council (term of one year): *A. D. Byler, Edison General Electric Appliance Company; *C. A. Bates, Bryant Electric Company; I. A. Bennett, National Electric Products Corporation; *F. C. Jones, Okonite Company; T. D. Montgomery, Cutler-Hammer, Inc.; *D. Hayes Murphy, Wiremold Company; H. H. Rudd, Railway & Industrial Engineering Company; Louis Ruthenburg, Copeland Products, Inc.; G. A. Waters, Wagner Electric Corporation.

From Policies Division (term of three years): *H. B. Crouse, Crouse-Hinds Company; Otto H. Falk, Allis-Chalmers Manufacturing Company; J. F. Kerlin, National Carbon Company; *S. L. Nicholson, Westinghouse Electric & Manufacturing Company; P. G. Postlethwaite, Wagner Electric Corporation; R. J. Russell, Century Electric Corporation; *J. H. Trumbull, Trumbull Electric Manufacturing Company.

The other members of the board are Louis Allis, *Wylie Brown, *D. R. Bullen, *Clarence L. Collens, H. T. Dyett, R. Edwards, *F. R. Fishback, *R. H. Goodwillie, *A. L. Lindemann, F. A. Merrick, *W. E. Sprackling, W. D. Steele, *C. H. Strawbridge and Gerard Swope.

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Weston Electrical Has Lower Earnings

OPERATIONS OF THE Weston Electrical Instrument Corporation for the six months ended June 30 resulted in a net profit of $70,656 after depreciation, etc. This compares with a net profit for the first half of 1930 totaling $448,884.

Net profits for the quarter ended June 30 amounted to $10,012 against $60,644 for the same quarter last year. The income account for the six months ended June 30, 1931, and 1930 respectively follows:

	1931	1930
Net after depreciation and expenditure	$84,634	$566,752
Other deductions	5,379	55,056
Total income	$79,255	$511,696
Federal tax	8,599	62,812
Net profit	$70,656	$448,884
Class A dividends	34,800	50,087
Common dividends	78,500	73,300
Deficit	$42,644	†$325,497

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General Electric Announces Fall Lighting Conferences

TWO CONFERENCES FEATURING home lighting and illumination design are scheduled for the month of November at the General Electric Lighting Institute, Nela Park, Cleveland. The first conference, to be held November 9 to 14, will be devoted to home lighting and is designed to tie in with the extensive residential lighting program being launched by the National Electric Light Association. At this conference the educational and promotional material being made available will be displayed and discussed in detail.

The second conference, to be held November 16-21, will consist of a general course in illumination. In addition to instruction in the design of installations for the older fields of lighting, such as store, show window, office, factory, etc., the newer fields such as aviation lighting, architectural lighting, and developments in electrical advertising will receive comprehensive treatment.

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Refrigerating Engineers to Meet

THE TWENTY-SECOND annual convention and educational exhibition of the National Association of Practical Refrigerating Engineers will be held at Houston, Tex., November 10 to 13. The convention headquarters will be at the Rice Hotel and all sessions of the convention, as well as the educational exhibition, will be held in the Houston Municipal Auditorium.

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Trade Practice Conference of Electrical Wholesalers

APPLICATION OF THE electrical wholesalers' industry for a trade practice conference to discuss ways of eliminating unfair trade practices said to be prevalent in the business has been approved by the Federal Trade Commission. This is the first of the fall conferences to be authorized by the commission.

Commissioner Charles H. March will preside at the conference, a definite time and place for which have not been determined, although the industry has asked that the meeting be held in Cincinnati in November.

Members of the industry applying for the conference do in excess of 60 per cent of the volume of wholesale electrical business in the United States. The annual volume is estimated at $500,000,000. The members handle such commodities as wiring and construction materials for electrical transmission, and for producing light, heat and power; appliances for generating electricity; radio sets, tubes and batteries, electric fans, washers, vacuum cleaners, irons, ranges, refrigerators, and the like.

Among practices proposed for discussion at the conference are the following: False advertising, interference with a competitor's business, selling goods below cost, price discrimination, commercial bribery, secret rebates and repudiation of contracts.

Westinghouse Receives Elevator Order

A CONTRACT FOR FIFTEEN electric elevators for the new ten-story United States parcel post building which will cover an entire block adjacent to the Pennsylvania Terminal, New York, was awarded to the Westinghouse Electric Elevator Company at a cost of $248,735.

Nine freight elevators, strategically placed to give maximum service and flexibility, are similar in mechanical and electrical detail and will differ from each other only in the number of openings which they serve. Each has a rated capacity of 8,000 lb. and a full-load-lifting speed of 200 ft. per minute. Combined they will easily transport more than 36 tons in one trip on a one-way average distance of 118 ft. in approximately 43 seconds.

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TRADE BRIEFS

James R. Kearney Corporation announces that Lou Meckler is associated with its district representative, T. B. Dally, in New York.

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George S. Miller has become Eastern sales manager for the Penn Heat Control Company, Philadelphia, a subsidiary of the General Electric Company.

•

International-Stacey Corporation has transferred headquarters of the Michigan division from Jackson, Mich., to Stephenson Building, Detroit.

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Electric Storage Battery Company has declared quarterly dividends of $1 each on the common and preferred stocks, placing the issues on a $4 annual basis, against $5 previously. Both dividends are payable October 1 to stock of record September 21.

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Gilbert Gislason has joined the U. S. Magnetic Products Corporation, Lock Haven, Pa., as special representative in the Great Lakes district and also in upper New York State.

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B. T. Ehrnman, formerly located in the Chicago office of the International-Stacey Corporation, has been transferred to St. Louis as division manager.

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Naugle Pole & Tie Company, 5 South Wabash Avenue, Chicago, has issued a book called "Specifications Wood Poles."

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Catalog No. 1290, describing "Bridge-Meg" and Varley loop "Bridge-Meg" resistance testers, an amply illustrated booklet describing the various uses and merits of these products, is announced by the James G. Biddle Company, Philadelphia.

Weston Electric Instrument Company has omitted the dividend on its common stock.

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The addition of a manufacturers' technical consultation service to its other activities has been announced by the Porcelain Enamel Institute, Chicago. The service, according to the announcement, is for manufacturers who wish to determine whether porcelain enamel is adaptable for use on their products.

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H. H. Crow is in charge of a sales territory for Ohio Brass Company in upper New York State.

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Electrical Manufacturing Holds Level

ELECTRICAL manufacturing activity in August departed only slightly from that of July, as gaged by monthly reports of energy consumed by plants in that industry. There was a decrease, but it amounted to only 2.4 per cent and was, in fact, smaller than is usual at this time of the year. The rise from July to August in 1930, shown in the table, was exceptional. Normally there is a drop of about 3 per cent. Contrasted with this, a relative upward movement may be seen, but only a slight one.

Comparative Index Numbers

	1931	1930
August	**128.0**	**152.2**
July	130.1	148.5
June	130.8	160.2
May	132.0	158.0
April	136.7	164.9
Average, eight months	134.5	157.3

Operations continue much below last year's level, the index now standing 16 per cent lower than it was a year ago. The eight-month average is down 14.5 per cent. Even at that, production is ahead of that in August of any other year except 1929 and 1930, and is down only 29 per cent from the peak, in October, 1929.

In view of the fact that other important industries are operating at less than 50 per cent of their peak month figure in 1929, it is apparent that the demand for electrical goods has, relatively speaking, held up remarkably well, and that the fluctuations in this industry have been of modest proportions.

The improvement in the North Central States, mentioned last month, appears to continue; one out of every three companies reporting from that section shows a greater energy consumption than in July, indicative of increased operations.

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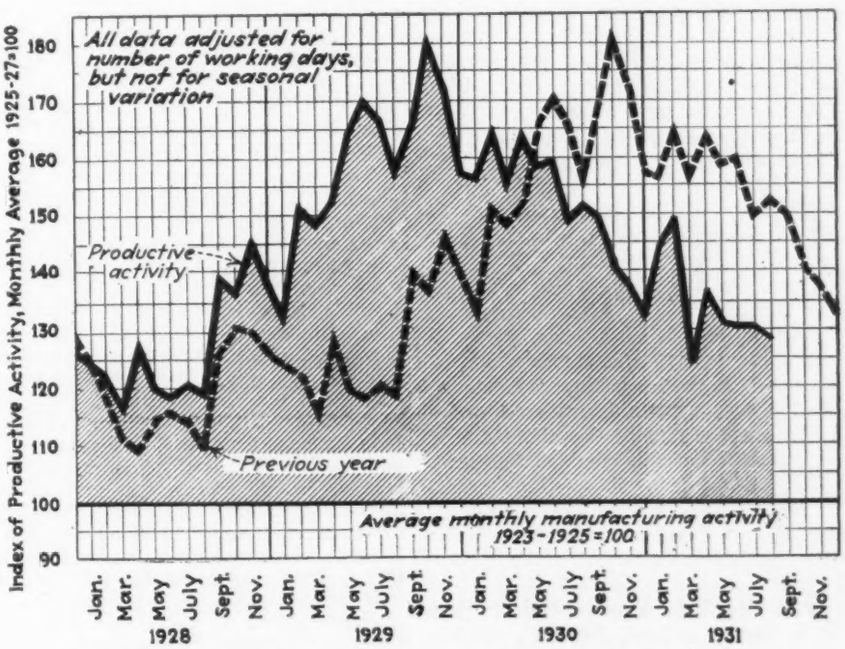
New York Metal Prices

	Sept. 16, 1931 Cents per Pound	Sept. 23, 1931 Cents per Pound
Copper, electrolytic	7.20	7
Lead, Am. S. & R. price	4.40	4.40
Antimony	6½	6.50
Nickel, ingot	35	35
Zinc, spots	4.10	4.05
Tin, Straits	25.05	23
Aluminum, 99 per cent.	23.30	23.30



Barometer of productive activity in the electrical manufacturing plants of the United States

Market Conditions

INQUIRIES on electrical equipment are increasing in the New England area, but actual orders are still slow in materializing. Industrial electric heating is a feature. Signs of returning stability in the equipment markets are evident, especially in the East. A better volume of business is in sight and prospective buyers are showing more inclination to make commitments, at least for actual requirements. A substantial volume of railroad business is said to be on the horizon.

——BUSINESS IS STILL ON A DECIDEDLY LIMITED BASIS in the Middle West and there is little indication of increased buying or reviving optimism.

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EASTERN

—DESPITE THE UNSETTLED *and indefinite conditions in the world's financial centers, improved stability is being shown in the electrical equipment markets throughout the Eastern section. There is a better volume of business in sight, if inquiries are to be taken as any indication, and prospective buyers are showing more inclination to close for requirements. Moreover, the improved operations in different important lines of industry and corresponding increased production schedules are assisting the situation materially.*

—RAILROAD ACCOUNT IS AGAIN *in the picture and some attractive business looms in that quarter if bidders will use judgment and keep their prices on a profitable basis. Price cutting and "penny profits" are prevailing evils of the day.*

A northern New York power company has placed a contract with a state manufacturer for transformers and switchgear to cost $85,000. Westinghouse Electric & Manufacturing Company has secured an order from Commonwealth Edison Company for the largest synchronous condenser ever built, for installation at its Crawford Avenue station, Chicago; the machine will have a capacity approximately 50 per cent greater than any similar existing unit and will cost about $250,000. National Power Machinery Company has tendered a low bid for a rotary converter for the city of Cleveland and is expected to secure the commitment. Eight bidders have submitted quotations to the Department of Commerce, Washington, D. C., on recent call for bids for 90 transformers and the award will soon be placed.

The Board of Transportation, New York, has a call out for bids, closing October 25, for 300, 500, 1,000 and 1,500 subway cars, representing the largest dollar volume inquiry in this line for many years. It is estimated that each car will cost from $30,000 to $40,000, making a gross award, likely to be let to one company, ranging from $9,000,000 to $60,000,000. The Pennsylvania Railroad Company is expanding its electrification program and proposes to electrify its branch line from Rahway, N. J., to Perth Amboy and South Amboy, N. J.; the work is scheduled for completion by next summer.

Electric elevator business continues under attractive prospects for sizable awards, some of which were referred to recently in these columns. Otis Elevator Company has obtained the contract for 50 units to be installed in the new Marshall Field Building, Chicago, the award approximating $1,000,000. Westinghouse Electric & Manufacturing Company is the successful bidder for fifteen electric elevators for the United States parcel post building, New York, aggregating $248,735.

CONSTRUCTION PROJECTS

Signal Supply Officer, United States Army, Signal Corps, Army Base, Brooklyn, N. Y., will receive bids until September 29 for quantity of cable and reel (Circular 22); until October 6 for ten 150-ft. self-supporting radio towers (Circular 25); until October 6 for quantity of sockets, 1,200 transmitters and other telephone supplies (Circular 17); until October 9 for 12,000 ft. of cable and four reels (Circular 24). Albany Port District Commission, Albany, N. Y., will receive bids until October 3 for grain elevator, estimated to cost $1,500,000. Armstrong Cork Company, Lancaster, Pa., plans plant at Martinez, Calif., to cost over $1,000,000. Pittsburgh & Lake Erie Railroad Company, Pittsburgh, Pa., will receive bids until September 30 for installation, maintenance and repair of interlocking signal and electrical plants for same, automatic block signals, etc. General Purchasing Officer, Panama Canal, Washington, D. C., will receive bids until October 9 for 5-hp. motor, electric blower, cable, magnet wire, air compressor, transformers, rectifier and other electrical supplies. (Schedule 2687.)

SOUTHWEST

—ALTHOUGH NOT SO MANY *orders of contract size have been closed in the past week, the demand for small apparatus continues good.*

An outstanding feature for the past ten days has been the demand for small farm-lighting units in certain localities. A considerable number of them have been sold in eastern Kansas, but one dealer, in northeast Arkansas has sent in orders for 25 sets in one week, paying cash. Contracts reported closed are for six motors and six turbines for an Illinois oil refinery to cost $14,000, a lot of underground cable worth $8,000 and a few orders for meters and transformers averaging about $100,000 each.

CONSTRUCTION PROJECTS

American Airways, Inc., Robertson, St. Louis, Mo., has filed plans for hangar and shop at Chicago, Ill., airport, to cost $125,000. Austin, Tex., has authorized extensions and improvements in municipal power plant to cost $314,000. University of Texas, Austin, has plans under way for engineering building and other structures to cost $4,500,000.

❖

SOUTHEAST

—THE DULL TONE *of business in the Southeast was very evident this week, with no indication when there would be an upward trend. Concerns reporting state that only small orders are being received and the total volume only fair.*

A Georgia company ordered last week $4,400 worth of transformers and transformer repair parts and its creosoted pine pole orders in the past ten days aggregated $4,100. This same company is in the market for a considerable amount of pole-line hardware. A North Carolina company ordered $3,500 worth of switching equipment, while a Florida company ordered $2,000 worth of transformers and more transformer business from the latter company is in prospect. One manufacturer reports the receipt of several small turbine orders aggregating $5,000 from oil mills in Mississippi. Ornamental street-lighting equipment amounting to $2,500 was ordered for a Tennessee town, while the city of Atlanta ordered cable and street lighting equipment amounting to approximately $2,000 for installation on a new viaduct.

CONSTRUCTION PROJECTS

Morris Plan Company, Richmond, Va., will build multi-story bank building to cost $500,000. Tidewater Power Company, Wilmington, N. C., contemplates extensions in transmission lines in vicinity of Beaufort, N. C. Board of Education, Nashville, Tenn., has plans for high

school at East Nashville, to cost $500,000. Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids until September 29 for an electric muffle furnace for navy yard at Pensacola, Fla. (Schedule 6565.)

❖

PACIFIC COAST

—THE PAST WEEK *has shown more outstanding orders than recently and certain encouraging features have been noted, such as better collections, slightly increased employment, the figure now running about 15 per cent for all industries, including public utilities, over last year, and increased buying in interior districts, due to expectation of crop money.*

—BUILDING CONSTRUCTION *continues to be largely public in character, with practically no sizable industrial construction and a decrease in residential. However, fundamental industrial prospects look especially favorable for early 1932, and certain public utility building and construction, such as new telephone exchanges and power extensions, are now in the draughting stage.*

Power company construction again takes first rank, including a 22-mile extension in the Siskiyou Mountains of an 11,000-volt line conveying 1,000 hp. and costing $60,000; a 20-mile line in the hop and grape district north of San Francisco, costing $70,000 to reconstruct; $5,000 worth of miscellaneous transformers, globes and tops for San Diego street lighting, and extension of electricity along the extreme easthern part of the state, bringing new towns such as Bridgeport into adequate service; two 2,000-amp., 750-kva., 15,000-volt circuit breakers for Los Angeles, a $40,000 street-lighting project for Sunset Boulevard in San Francisco, a $15,000 Westinghouse cubicle order for a Northwest lumber company, and $30,000 worth of General Electric transformers for Lodi.

Railroad ordering includes a quarter's requirements of safety switches of various sizes and schedule wiring material. Prices in copper wires have dropped sharply due to recent basic copper decrease, but prices in general are fairly steady with an increasing trade desire for prices which give a fair and necessary rate of gross profit to the dealers.

Bureau of reclamation, Denver, taking bids until October 20 for two 2,300-hp. vertical hydraulic turbines, two governors and governor pumps, two 1,875 kva. alternating-current generators complete with direct-connected exciters and thrust bearings and one power plant switchboard and auxiliary apparatus for the Grand Valley power plant. The city of Tacoma authorized the sale of $500,000 in bonds to cover cost of extensive improvements to its distribution system, including underground lines.. The city of Seattle opened bids for 100,000 ft. of $\frac{7}{16}$- and $\frac{1}{4}$-inch galvanized guy wire. Motor and apparatus sales reported include two 60 hp. and one 5 hp. motor, navigation and bridge lights and conduit, approximating $8,000 for the Northern Pacific Railway bridge in Seattle, 50 motors from 100 hp. down to pulp, paper and lumber mills and allied industrials, twenty machines from 50 hp. down to coal mines, irrigation and sawmills, 35 machines from 75 hp. down to miscellaneous sources, including dealers.

CONSTRUCTION PROJECTS

Vallejo Electric Light & Power Company, Vallejo, Calif., plans power substation to cost $100,000. Texas Company, Los Angeles, Calif., contemplates improvements in oil plant at Kettleman Hills, Calif., to cost over $200,000. Six Companies, Inc., 405 Montgomery Street, San Francisco, Calif., contractor for Hoover Dam, Boulder City, Nev., plans sand and gravel plant at that place with electric-operated machinery, to cost $250,000. Bureau of Reclamation, Denver, Colo., will receive bids until October 20 for two 1,875-kva. a.c. generators, two 2,300-hp. vertical hydraulic turbines, exciters, switchboard and auxiliary equipment for Grand Valley power plant, Grand Valley project, Colo. (Specification 528.)

❖

MIDDLE WEST

—VERY LITTLE, IF ANY, *encouragement can be derived from general business this week in the Middle West section. While the volume of business is substantially the same; general business is bumping along an extremely uneven course, with no immediate prospects for betterment.*

—THE DETERMINATION *to carry on is quite evident, although recent international complications, the insecure postion of the security market and announcements of further wage reductions are rapidly dissipating any remnants left of forced optimism.*

Although some seasonal improvement is observed in building activity and in the production of coal, the ouput of steel and electrical energy is at a low level. Car loadings continue to decline, railroad equipment and maintenance purchasing is negligable and retail sales are off to a considerable extent. The various utility companies are continuing with their construction and extension programs, although the possibilities of increased activities are at the present moment quite remote. Some of the interesting items placed this week include 100 10-kva., 25 37½-kva. and six 150-kva., single-phase pole type distribution transformers, ten 5-amp., 100 10-amp. and ten 50-amp. maximum demand meters, storage battery equipment to cost $25,000 and "Mazda" lamps valued at approximately $125,000.

CONSTRUCTION PROJECTS

Superintendent of Lighthouses, Milwaukee, Wis., will receive bids until September 30 for quantity of submarine electric cable for installation in Carter Harrison tunnel, Chicago, Ill. Detroit Edison Company, Detroit, Mich., has authorized appropriation of $1,070,000 for extensions and improvements in Connors Creek steam-operated electric generating plant. Signal Corps Procurement District, United States Army, Chicago, Ill., will receive bids until September 29 for one telephone switchboard (Circular 18). State Legislature, Bismarck, N. D., has authorized plans for state capitol building estimated to cost $2,000,000.

❖

NEW ENGLAND

—REPORTS OF INCREASING *inquiries relative to electrical equipment are noted in this district, with a tendency to delay ordering. Sales are confined for the most part to necessities for maintenance of service, with no interest in buying for expansion or changes in plant status.*

—SMALL MOTOR SALES *are reported by prominent manufacturers and fractional-horsepower motor orders are gaining with the trend growing among local machine manufacturers.*

Industrial electric heating is attracting attention. One manufacturer notes sale of a 36-kw. special purpose furnace, while another reports sales of small melting pots on the increase, with inquiries presaging a number of orders in the near future. Sales of street-lighting equipment are steady. One manufacturer reports activity in negotiations and interest in floodlighting for playgrounds and service stations. Volume of 500 watt light sales are gaining this month and a gradual building up the volume of appliance sales in the northeastern section of this district is reported.

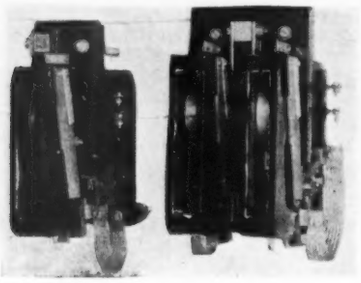
CONSTRUCTION PROJECTS

Treasury Department, Washington, D. C., has plans under way for a federal building at Andover, Mass., to cost $125,000. Commonwealth of Massachusetts, Boston, is having plans drawn by Department of Correction for group of buildings at its state prison colony, Norfolk, Mass., to cost over $500,000.

New Equipment Available

Heavy-Duty Contactor for Magnetic Controllers

A HEAVY-DUTY CONTACTOR for steel mill, crane and general-purpose direct-current magnetic controllers has been developed by the Westinghouse Electric & Manufacturing Company. These contactors are compact and may be mounted close together, since all parts are removed from the front for replacement.



A highly effective rupturing capacity is obtained by a new high-speed operation and especially designed arc box and horns, along which the flux blowout forces the arc. The fast opening of contacts assists in the rapid extinction of the arc, thus prolonging the lift of contact tips, arc box and other adjacent parts.

▼

AN EXPULSION TYPE, FUSIBLE TRANSFORMER CUTOUT, rated at 5,000 volts and 60 amp., has been placed on the market by the Porcelain Products, Inc., Parkersburg, W. Va. While of a conventional design in general it offers several new features not heretofore found in transformer cutouts, it is claimed. The cutout housing is of high-tension wet process porcelain. As an additional operating safeguard to the lineman, the door is also of high-tension wet process porcelain and of rugged design to withstand shock and considerable handling. Bracket and U-bolt are provided for convenient crossarm mounting.

▼

Positive Thermostatic Snap Switch

A POSITIVE SNAP-ACTION 1,000-watt a.c. capacity thermostatic switch for electric flat irons and other thermostatically controlled heating appliances has been announced by Robbins & Myers, Inc., Springfield, Ohio. It maintains any desired temperature over a total heat range from atmospheric temperature to 525 deg. with a maximum variation of only 5 deg., it is claimed. A special low-temperature switch with a differential of but 2 deg. is also being placed on the market.

Other features of this new switch are simplicity, compactness of construction and long life. It has but two moving parts, which results in greater durability and more dependable performance. It can be installed as part of the final assembly job and can be made to either open or close with temperature increase.

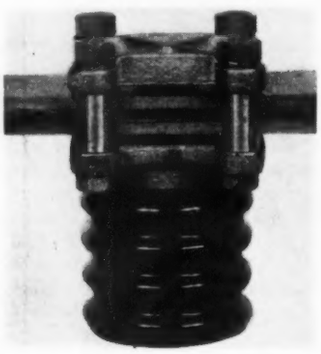
▼

A NEW PUMPING UNIT KNOWN as the "Monobloc" centrifugal unit has been placed on the market by the Worthington Pump & Machinery Corporation, Harrison, N. J. The pump, simple and rugged, is bolted to the extended motor frame and the impeller is mounted on the end of the continuous motor shaft. The bronze impeller incorporates the shaft sleeve as an integral part, this construction being one of Worthington's latest shaft-protection developments.

▼

Roller Type Bus Clamp Has Spring Spacer

A NEW ROLLER TYPE BUS CLAMP with a spring spacer between bars has been announced by the Delta-Star Electric Company, Chicago. It takes the adjustment and tightening of the clamping bolt out of the hands of the electrician and automatically transfers it to the spring spacer between the bars. Spacers slipped over the clamping bolts permit tightening of the bolts for all time, but the spring spacer between



the bars assures a proper predetermined pressure against the stainless steel rollers.

The new roller clamp eases stresses on the porcelain due to bus expansion and also eases the longitudinal pull on the porcelain during short-circuit stress.

Turbine Bleeder Line Non-Return Valve

A TYPE OF VALVE suitable for the protection of turbines of the bleeder type from back-flow of steam, condensate or feedwater has been announced by the Davis Regulator Company, Chicago, Ill. It is of the lift-disk type with secondary oil cylinder control. The disk is free to close when a back-flow of any kind occurs. In addition to this a positive

means of closing is provided by an oil power cylinder mounted on the valve cover either above or below the valve. This cylinder is connected to the turbine lubricating system.

It is made in sizes ranging from 2 in. to 24 in., of steel, semi-steel or cast iron, and is trimmed for saturated or superheated steam.

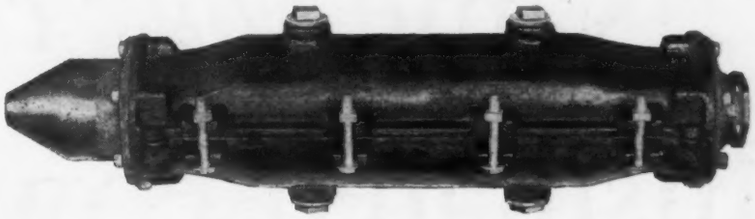
▼

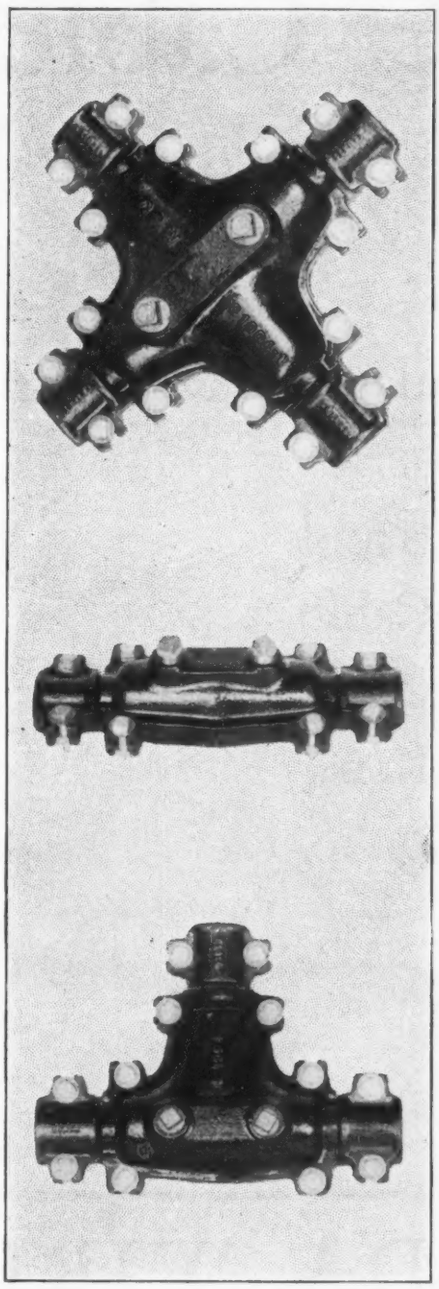
Single Operator Welding Sets

A NEW LINE OF single-operator welding sets in which are incorporated many improvements over past designs has been announced by the General Electric Company. This has been designated the WD-20 line, as the types are numbered WD-21, 22, 23, 24 and 26, covering the 100, 200, 300, 400 and 600 amp. ratings respectively. It includes both portable and stationary sets for alternating or direct current at all standard voltages and in the case of alternating current standard frequencies and 2- and 3-phase gasoline-engine-driven sets will also be available.

Among the principal advantages of the line are the use of two-bearing construction on the a.c. types up to 600 amp. and compactness and light weight. The sets are self-excited, with a tapped series field for major current adjustments and a shunt field rheostat giving duplex voltage control.

G&W SPLICE BOXES





There is a proper splice box for your requirements, and G&W has it. Several different types of splice boxes in many sizes are always carried in stock.

Illustrated above is the standard splice box equipped with a combination clamping ring and stuffing box at one end, and a wiping sleeve at the other. Different types of entrances are interchangeable.

The Airport Cable splice boxes at the left are of malleable iron. The outer clamp grips the cable armor. The inner clamp secures the inner sheath, sealing the box from compound leakage. This construction has been approved by the U. S. Government.

You will find G&W Splice Boxes correct to the smallest detail. The large brass pipe plugs make proper compound filling easy. All hardware is corrosion resisting. All parts are accurately fitted.

STANDARDIZE ON G&W SPLICE BOXES

For more detailed information, consult Catalog 30 or write

Potheads • Subway Boxes • Cable Terminal Devices • Automatic Transfer Switches

G&W Electric Specialty Co.

7780 Dante Avenue, Chicago • • • • Representatives in Principal Cities

Name *your choice* of Insulated Power Cable

...*we make it*

Anaconda offers Insulated Power Cables of superior quality for all purposes and a complete line of Cable Accessories . . . potheads, junction boxes, filling compounds, etc. . . . . .

ANACONDA

offers a *complete* cable service.

ANACONDA WIRE

—Paper Insulated Lead Sheathed Power Cable

—Varnished Cambric Insulated Power Cables (Braid or Lead Covered)

—Rubber Insulated Power Cables (Braid or Lead Covered)

—Parkway Cables

—"Duraseal" Non-Metallic Sheathed Cables

—Submarine Cables

Whenever you require electrical Wires and Cables, think of Anaconda. Somewhere in our complete offering of 81 products, we have exactly what you need for any transmission or distribution problem.

& CABLE COMPANY

ORANGEBURG FIBRE CONDUIT

easily handled
rapidly installed
lasts a lifetime

ORANGEBURG FIBRE CONDUIT really does the job it is supposed to do—it assures permanent trouble-free protection to underground cableways at low cost. For the past 38 years, leading public utility companies, municipalities and conduit users in all parts of the world have standardized on Orangeburg Fibre Conduit.

This time-tested underground ductway is available in lengths of 5 and 8 feet. Carefully made always, of uniform diameter and smooth interior finish, it forms perfect joints that insure proper alignment, prevent seepage...protect cableways from abrasion in pulling through.

Its light weight makes Orangeburg Fibre Conduit easy to carry, reduces transportation and handling costs and insures rapid, accurate application.

Large stocks are carried at the manufacturing plants in Orangeburg, N. Y., and Richmond, Ind., as well as in all larger cities, making it possible to fill orders from any part of the country promptly and completely.

The Fibre Conduit Co.

ORANGEBURG, NEW YORK

SOLE SELLING AGENT **Johns-Manville** 292 MADISON AVENUE NEW YORK CITY

What Size Conductor?

There is a New O-B *Light-Weight* SUSPENSION CLAMP FOR IT

PRESENT practice in transmission line construction imposes definite requirements on suspension clamps. Fixed tolerances are established. Larger conductors are being used. Methods for reducing conductor vibration fatigue are becoming established practice in the construction of new lines and for maintenance of existing lines.

These changed conditions have been responsible for the design of the new O-B *light-weight* suspension clamps.

Nine sizes, the smallest with a cable seat diameter of 1 inch and the largest with a diameter of 2¼ inches, accurately provide the most satisfactory clamp for the conductor for which it was designed—with the proper tolerances for each size.

These new clamps, in addition to establishing a standard line of comparable sizes and weights, offer the marked advantage of a reduction of from 20% to 30% in weight—a most important advantage in these days when light weights can mean so much in costs.

A compact design, employing a cable seat of correct curvature to most effectively accommodate the conductor, with thin metal sections, makes possible this much lighter line of suspension clamps.

By employing O-B Flecto iron, these thin sections offer adequate strength, the Flecto process assuring a hot-dip galvanized casting without internal weakness or embrittlement; high in corrosion resisting qualities, ductility, and with greater tensile strength. Reports of technical societies and individual research have shown that malleable cast iron has the highest corrosion resisting properties of any of the low-cost ferrous metals.

The familiar spherical design which assures, in the O-B clamp design, most satisfactory electrical characteristics, has been fully retained, as well as the mechanical design features which have proved so valuable in years gone by.

So, no matter what cable size is contemplated, there is a clamp in this new standard line of O-B *light-weight* suspension clamps that was designed expressly for that size. O-B representatives can supply complete information. Or, if you wish, address

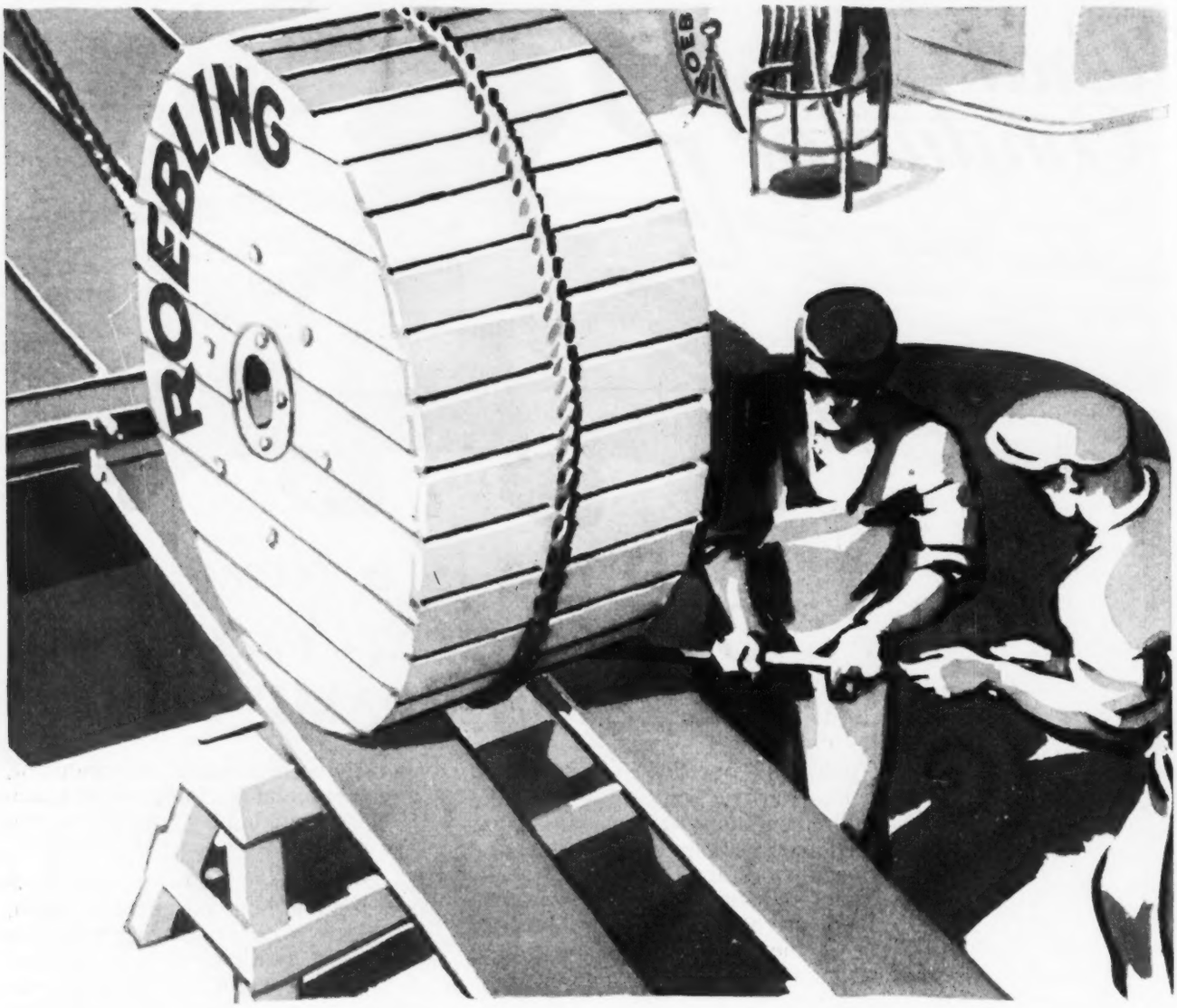
1440H

OHIO BRASS COMPANY

Mansfield, Ohio, U. S. A.

Canadian Ohio Brass Co. Limited — Niagara Falls, Ontario, Canada

New York · Philadelphia · Boston · Pittsburgh · Chicago · Cleveland · St. Louis · Atlanta · Dallas · Los Angeles · San Francisco · Seattle



ROEBLING

IT MAKES no difference what kind of electric wire or cable you need—whether Type H impregnated paper insulated cable, rubber insulated cable, varnish-cambric-insulated, parkway cable, or merely annunciator wire—you can get it from Roebling.

Listed are only a few of the more than 60 different types of Roebling Wires and Cables. Many of these are carried in stock at the warehouse points below and can be shipped immediately.

Your request for further information about Roebling Electric Wires and Cables would be welcomed by our nearest office.

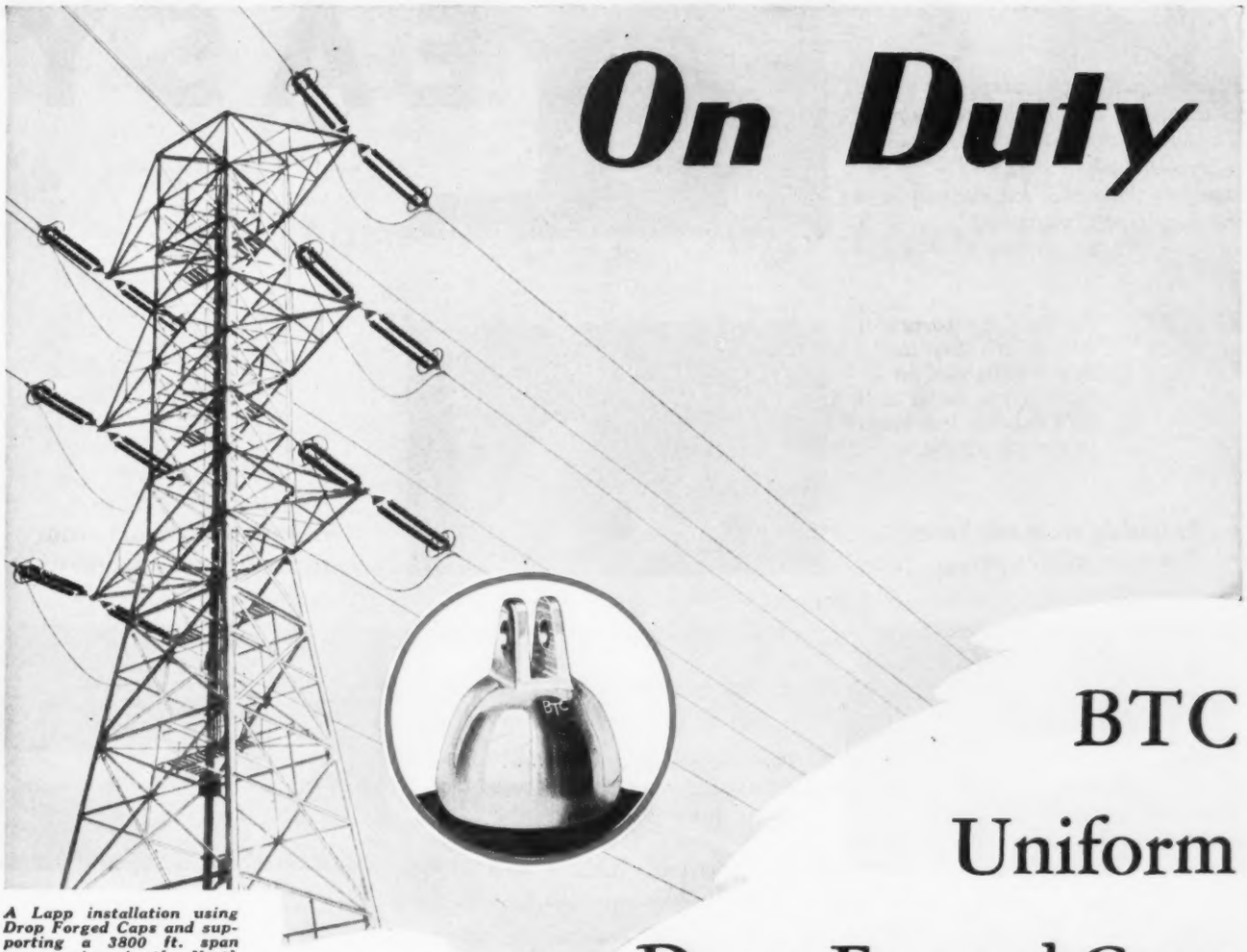
Power Cables · Paper; Cambric; Rubber » Submarine Cables » Tree Wire » Parkway Cable » Service Cables » Station Cables » Rubber Covered Control Cables » Rubber Covered Wires and Cables · Braided and Leaded · Code: Intermediate; 30% » Slow-burning Wires and Cables » Weatherproof Wires and Cables » Portable Cords » And a wide variety of other wires and cables.

JOHN A. ROEBLING'S SONS COMPANY, TRENTON, N. J.

Atlanta Boston Chicago Cleveland Los Angeles New York Philadelphia Portland, Ore. San Francisco Seattle Export Dept., New York, N.Y.

ELECTRICAL WIRES AND CABLES

On Duty

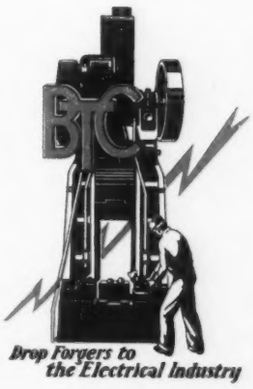


A Lapp installation using Drop Forged Caps and supporting a 3800 ft. span over a river in the North Central part of the United States.

BTC Uniform Drop Forged Caps

Why a Drop Forged Cap?

1. They are uniform in quality.
2. They are superior in strength.
3. They are uniform in dimensions.
4. They can be heat treated to give maximum strength with minimum weight.
5. They have precision milled joints and drilled holes.
6. They are free from hidden defects and concealed flaws.
7. They give extra protection to your lines.



Drop Forgers to the Electrical Industry

The engineer who builds a high tension transmission line builds for the future. Every conceivable safeguard, every possible precaution is taken. Consider then, in the face of a price market, the danger in accepting unknown, unbranded insulator caps.

Engineers the country over have welcomed and have shown their acceptance of standardized BTC drop forged caps by the many installations now in evidence. Price factors did not enter into these specifications—by merely specifying a BTC drop forged cap they were assured of one quality, uniformity and strength. Play safe, insist on a cap you know.

THE BREWER-TITCHENER CORPORATION
Cortland, New York

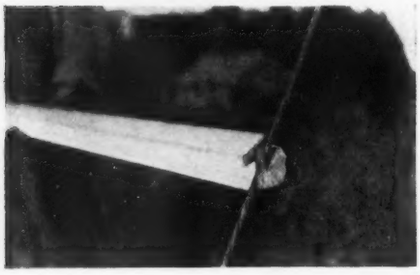
ASK YOUR INSULATOR MANUFACTURER

EASY

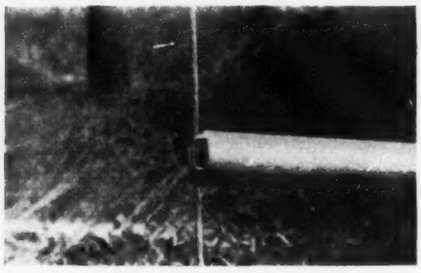
Place the guard along side the guy strand so the lower end reaches the ground. The hole in the guard should come directly over the bolt to be used in the guy clamp so the anchor rod eye will be in the deep part of the guard.

Remove the particular bolt in the guy clamp that is to be used for attaching the guard and turn rod until bolt heads in guy clamp are up.

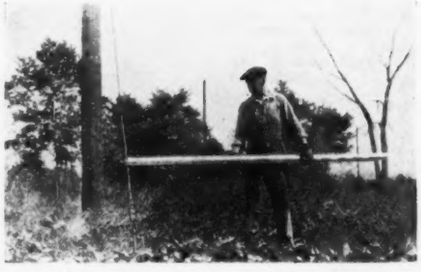
Installation made from left side of guy wire.



Installation made from right side of guy wire.



Place the guard at right angles to the strand and engage strand with the clamp at top of guard.



When the strand is engaged from the right-hand side, the trough of the guard is down. When it's engaged from the left-hand side, the trough of the guard is up and is turned down as guard is moved into the strand.

Slide top clamp up along the strand.

At the same time move the bottom part of the guard towards and over the strand.

(See illustrations on right hand page)

Place the bolt for attaching through the guard and guy clamp and run nut up tight.

TO INSTALL

Matthews Guy Guard consists of only one metal piece.... No other parts

EASE and speed of installation is another of the outstanding features of the Matthews Guy Guard. The Matthews Guard is all one piece and its installation requires no U-bolts, set screws or other parts. Any one of the guy clamp bolts will make the attachment secure and the guard at once becomes an integral part of the guy.

The Matthews Guard is quickly installed from the ground, from either the right or left side of the guy. There are several places where the guard may be attached to the guy clamp—a feature which permits the installation to be adjusted so the eye of the anchor rod will rest in the deep part of the guard. This flexibility also takes care of protruding anchor rods.

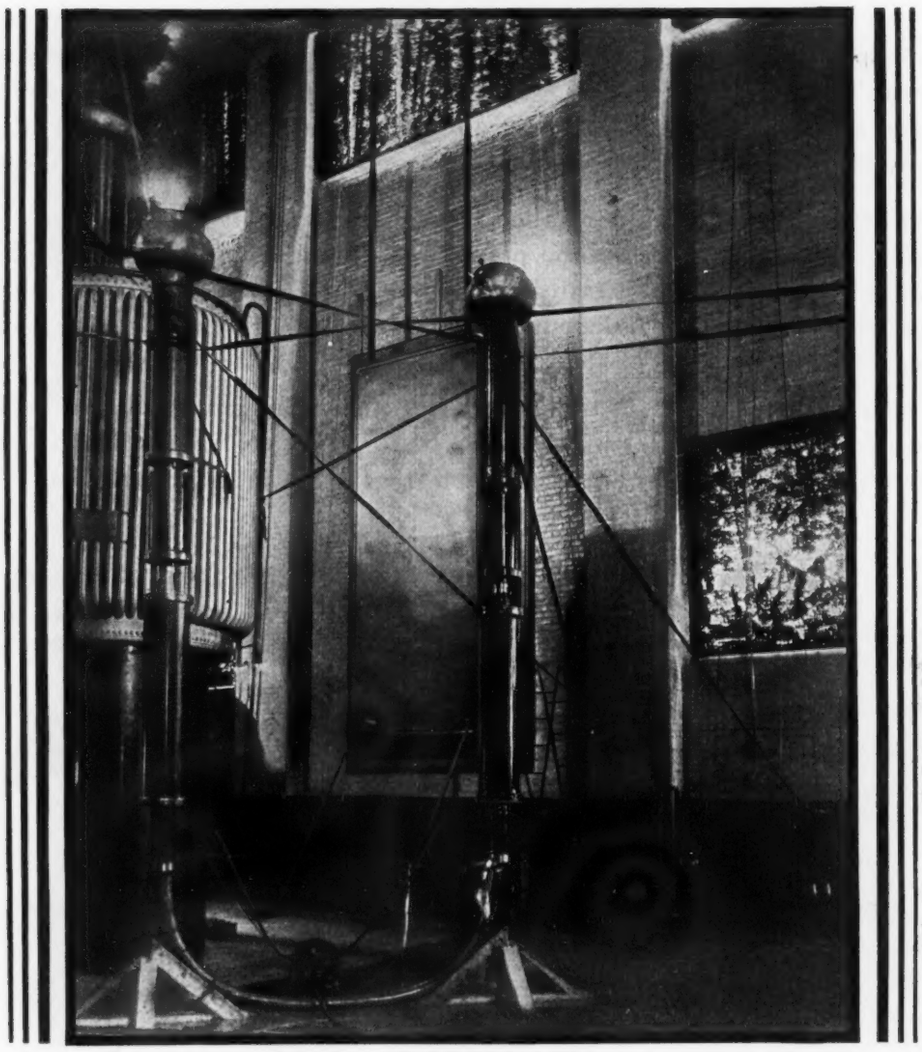
Matthews Guy Guards nest 70% one within the other. This nesting feature saves 14% to 24% on freight rates and also saves space in store rooms and on line trucks. W. N. Matthews Corporation, Engineers and Manufacturers, St. Louis, Mo.

MATTHEWS GUY GUARD

EW-9-26

220,000 VOLT OIL-FILLED CABLE TESTED AT 725,000 Volts

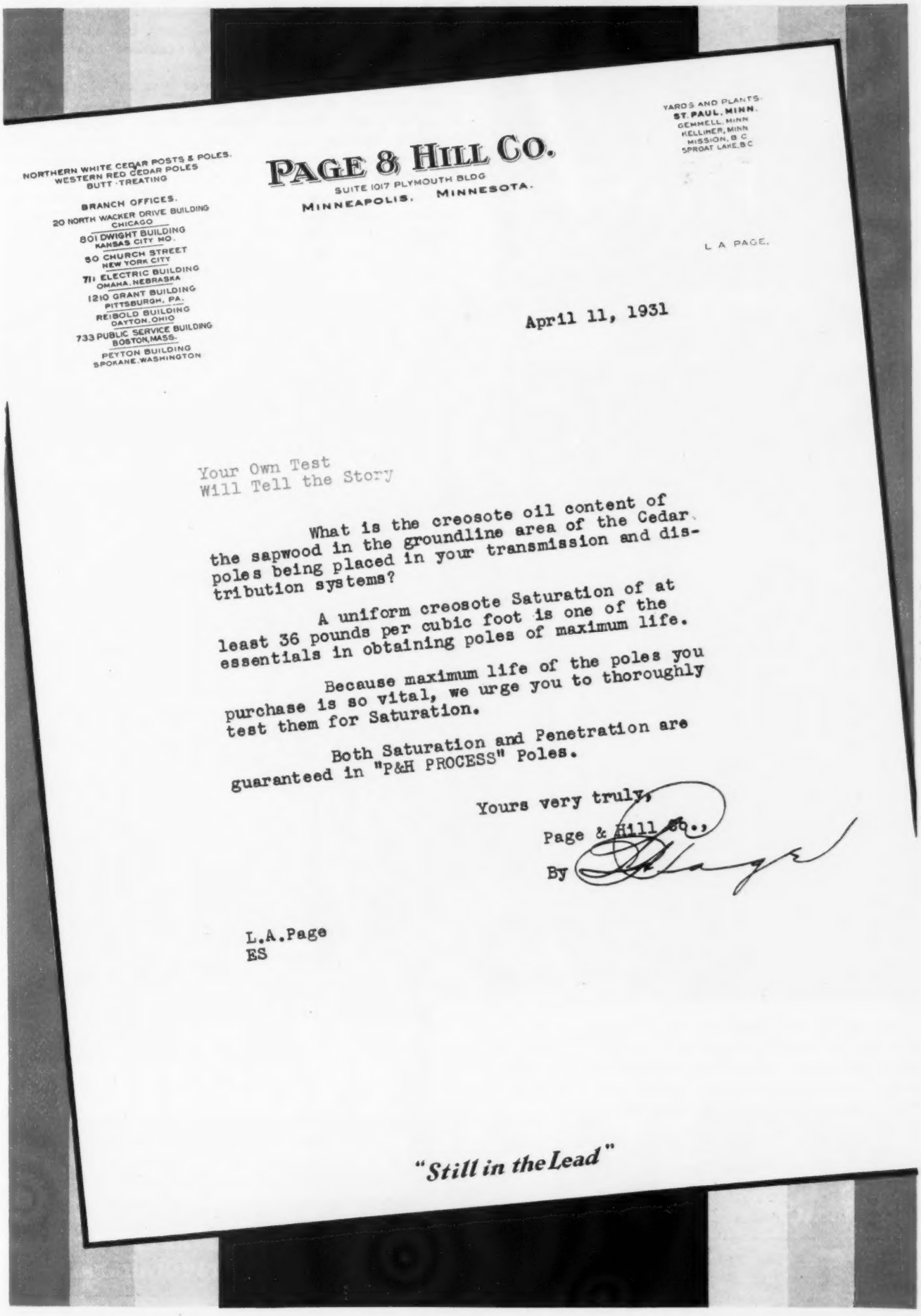
(CREST VOLTAGE - 1,020,000 VOLTS)



This is the highest A-C test voltage ever applied to a cable. It required the development of 1,000,000 volt condenser type terminals . . . which were especially designed and constructed by General Cable's Research and Development Laboratories.

GENERAL CABLE CORPORATION

EXECUTIVE OFFICES. 420 LEXINGTON AVENUE, NEW YORK CITY



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L A PAGE.

April 11, 1931

Your Own Test
Will Tell the Story

What is the creosote oil content of the sapwood in the groundline area of the Cedar poles being placed in your transmission and distribution systems?

A uniform creosote Saturation of at least 36 pounds per cubic foot is one of the essentials in obtaining poles of maximum life.

Because maximum life of the poles you purchase is so vital, we urge you to thoroughly test them for Saturation.

Both Saturation and Penetration are guaranteed in "P&H PROCESS" Poles.

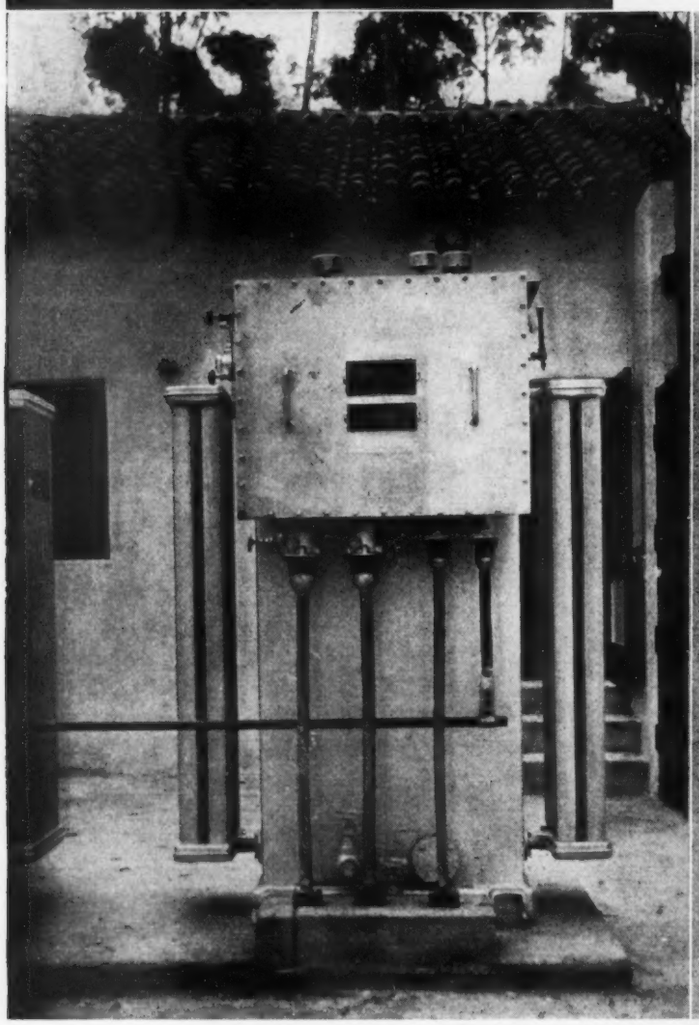
Yours very truly,
Page & Hill Co.,
By

L.A.Page
ES

"Still in the Lead"

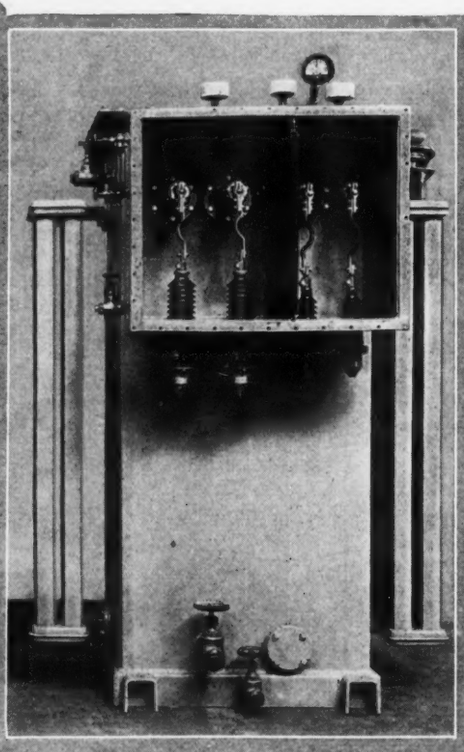
Safety First!

The use of junction boxes and potheads on transformers not only safeguards the lives of attendants, but also makes it unnecessary to take elaborate precautions against accidental injury to unauthorized persons. » » » There is no yardstick for measuring the value of lives lost at substations —but there IS a value, and the power companies pay for it out of profit. Where Wagner pothead transformers are installed, damage claims decline. » » » And there are other reasons for preferring Wagner pothead transformers. Substations cost less and are neater. There is no costly, cumbersome superstructure—no maze of posts, cross-arms, bus-bars, wires, insulators—no superstructure maintenance. Just the transformers, with underground cables leading to and from them. » » » On pages 53 and 54 of Wagner Bulletin 170 is a detailed description of Wagner pothead



At Left—One of a bank of four 500 Kv-a. 16,500 to 2,400 volts Wagner transformers.

Below—Same transformer, with terminal box cover removed to reveal pothead assembly.



design and construction. Ask for a copy of Bulletin 170 and read about these transformers, as well as all the other types of power transformers manufactured by Wagner.

WAGNER ELECTRIC CORPORATION,
6400 Plymouth Ave., St. Louis, Mo.

Please send copy of your new Bulletin 170 illustrating and describing Wagner Power Transformers.

Name and Position .....

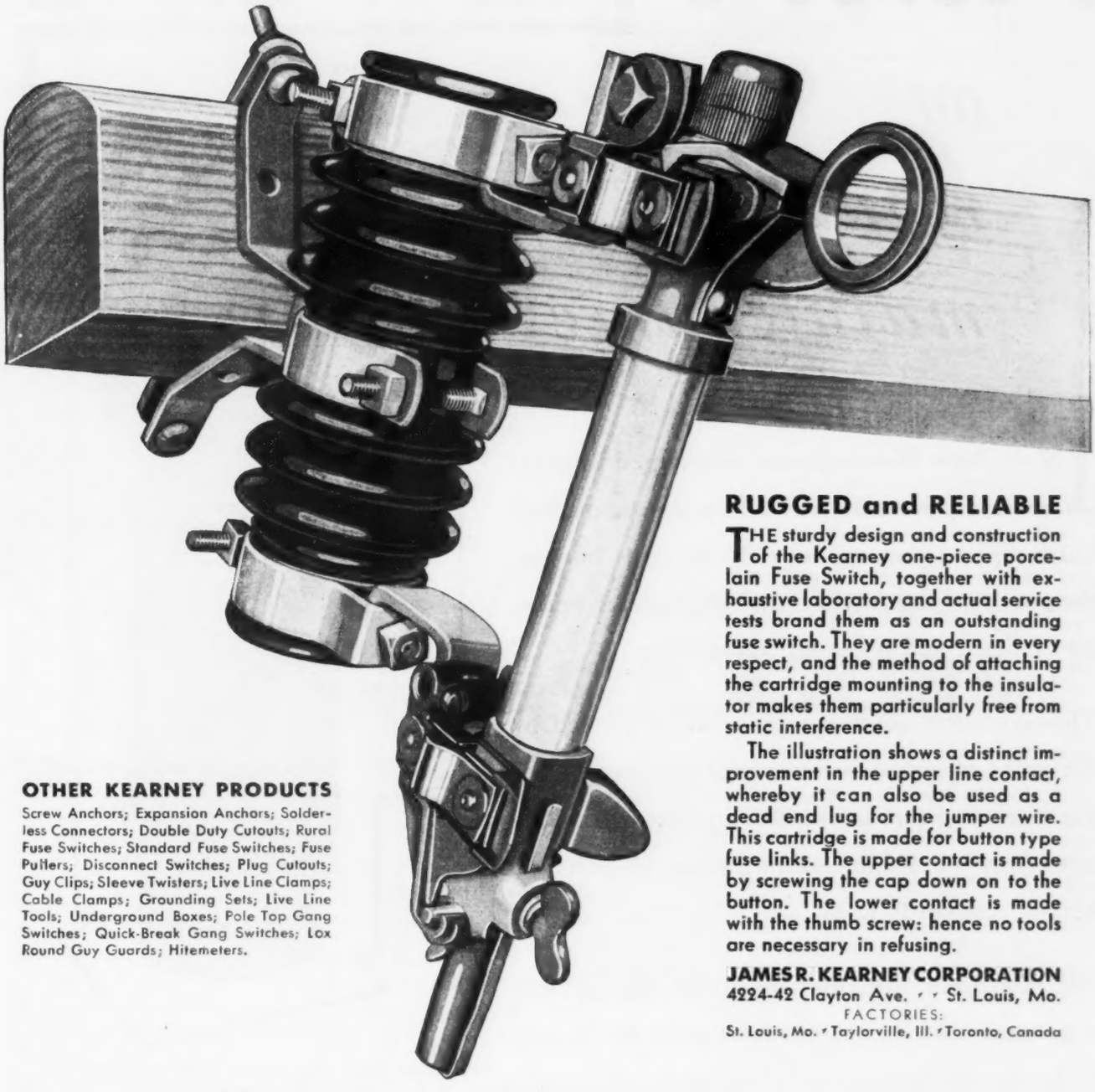
Company .....

Address T331-7XB

Wagner
Electric Corporation
6400 Plymouth Ave., St. Louis, U. S. A.

Motors Transformers Fans
Lockheed Hydraulic Brakes

MODERN *in* EVERY DETAIL



RUGGED and RELIABLE

THE sturdy design and construction of the Kearney one-piece porcelain Fuse Switch, together with exhaustive laboratory and actual service tests brand them as an outstanding fuse switch. They are modern in every respect, and the method of attaching the cartridge mounting to the insulator makes them particularly free from static interference.

The illustration shows a distinct improvement in the upper line contact, whereby it can also be used as a dead end lug for the jumper wire. This cartridge is made for button type fuse links. The upper contact is made by screwing the cap down on to the button. The lower contact is made with the thumb screw: hence no tools are necessary in refusing.

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KEARNEY

RURAL LINE FUSE SWITCHES

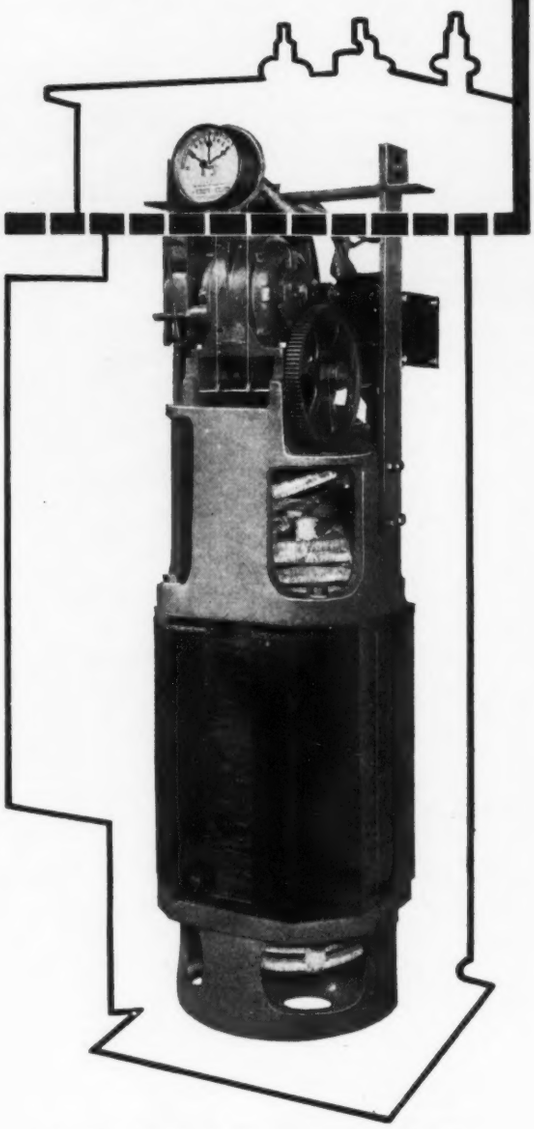
Here's a NEW LINE

on regulator maintenance

IN the New Westinghouse Submerged Regulator every wearing part is beneath the oil line. Oil completely covers not only the coils, but also the operating motor, the limit switch, gears, brake, and current and potential transformers.

This complete submerging in oil as proved by six years of actual service, bars any wearing of the operating mechanism. It eliminates the necessity of periodical lubrication because all parts are bathed constantly in oil.

For complete information about this modern regulator, ask our nearest sales office for a copy of Leaflet 20496.



Westinghouse Type S (Submerged) Regulator. Dotted line indicates oil level.

Service, prompt and efficient, by a coast-to-coast chain of well-equipped shops

Westinghouse

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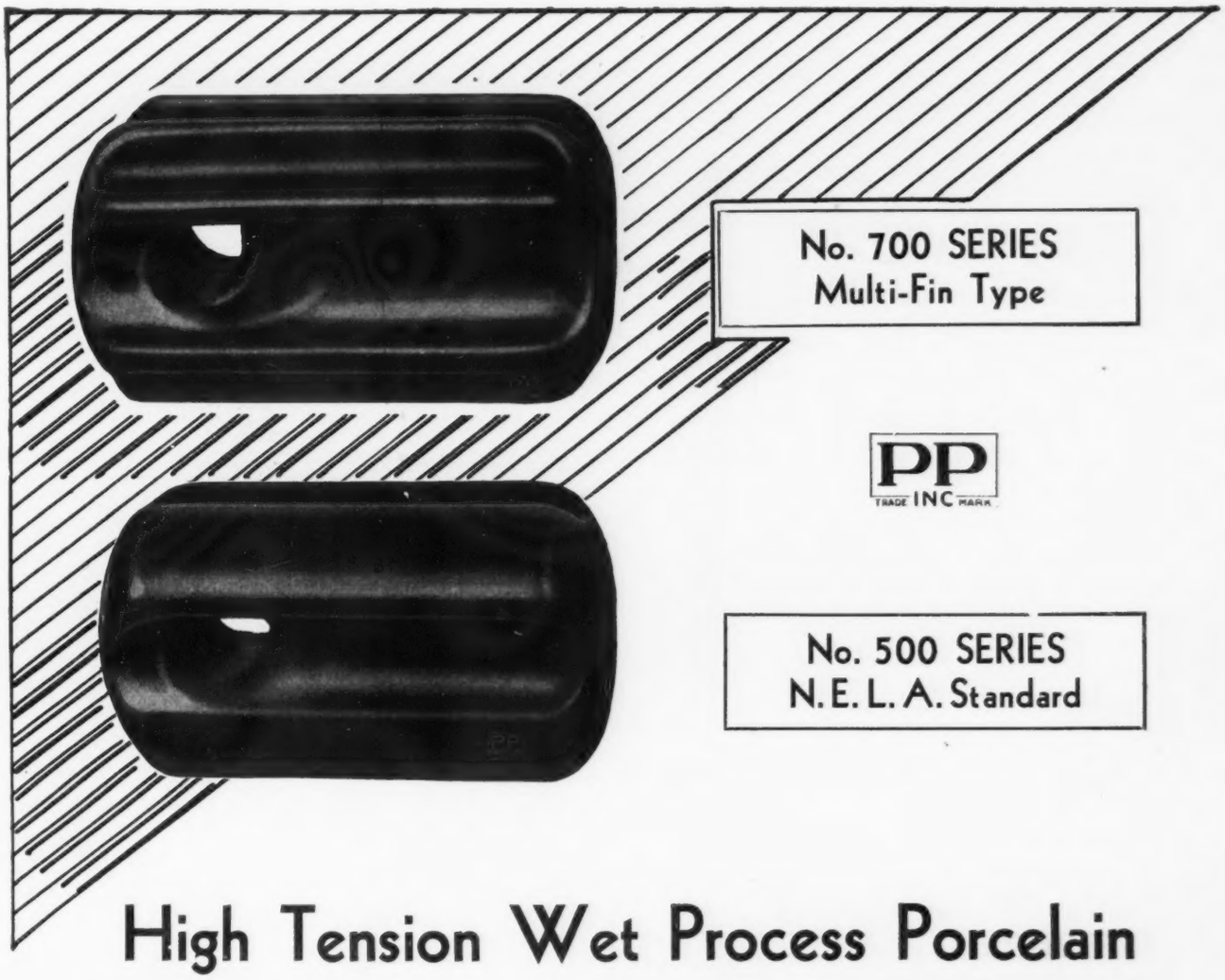

High Tension Wet Process Porcelain
STRAIN INSULATORS

Here are Strain Insulators that can be depended upon to carry the anticipated load with that usual necessary factor of safety.

Both No. 700 Series and No. 500 Series have been designed especially for strain positions and hard service.

Made of the highest quality High Tension Wet Process Porcelain and by the latest approved methods, these Strain Insulators provide a maximum leakage and embody a mechanical stability unsurpassed by other types of strain insulators.

While each strain insulator goes through a rigid factory routine test and inspection, daily laboratory tests are also conducted for electrical and mechanical values as well as porosity. This constant watchfulness is your assurance of quality Strain Insulators.

Brown Glaze Standard.

OUR OTHER PRODUCTS INCLUDE:—

High Tension Wet Process Porcelain Insulators for Transmission and Distribution Lines.

Special Insulators and Bushings of High Tension or Low Tension Porcelain.

Secondary Racks, Insulated Clevises, House Brackets and Service Knobs.

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PORCELAIN PRODUCTS, INC., *Parkersburg, W. Va.*

LARGEST PRODUCERS IN THE WORLD OF ELECTRICAL PORCELAIN

UNION METAL FLUTED STEEL

"THEY'LL ALL BE USING STEEL POLES IN A FEW YEARS" . . .

In the course of a conversation a utility man said recently, "They'll all be using steel poles in a few years". Merely a casual remark, but it indicates an appreciation of the rapidly growing preference for steel poles for transmission and distribution lines.

It is indicative of the acceptance of a new material which has proven more efficient than the old. Another utility executive wrote us, "My personal opinion is that the wood pole is not so extensively used in the utility industry because of the impossibility of finding a suitable substitute but rather because its use has become somewhat of a habit as a result of long standing custom. From an engineering point of view, I see no reason why the steel pole cannot successfully replace the old wooden pole. . . ."

FLUTED STEEL Poles are far superior to any pole ever offered the utilities. Their strength permits unusually heavy loading. Installation is simple. They give many long years of trouble-free service. On city streets where appearance is important, you will find that Fluted Steel Poles build good will because they harmonize so well with city architecture.

You should have complete engineering data on Union Metal Poles in your files. Write for a copy of Catalogue No. 63 today.

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◀ Fluted Steel Poles installed at Tallahassee, Fla.

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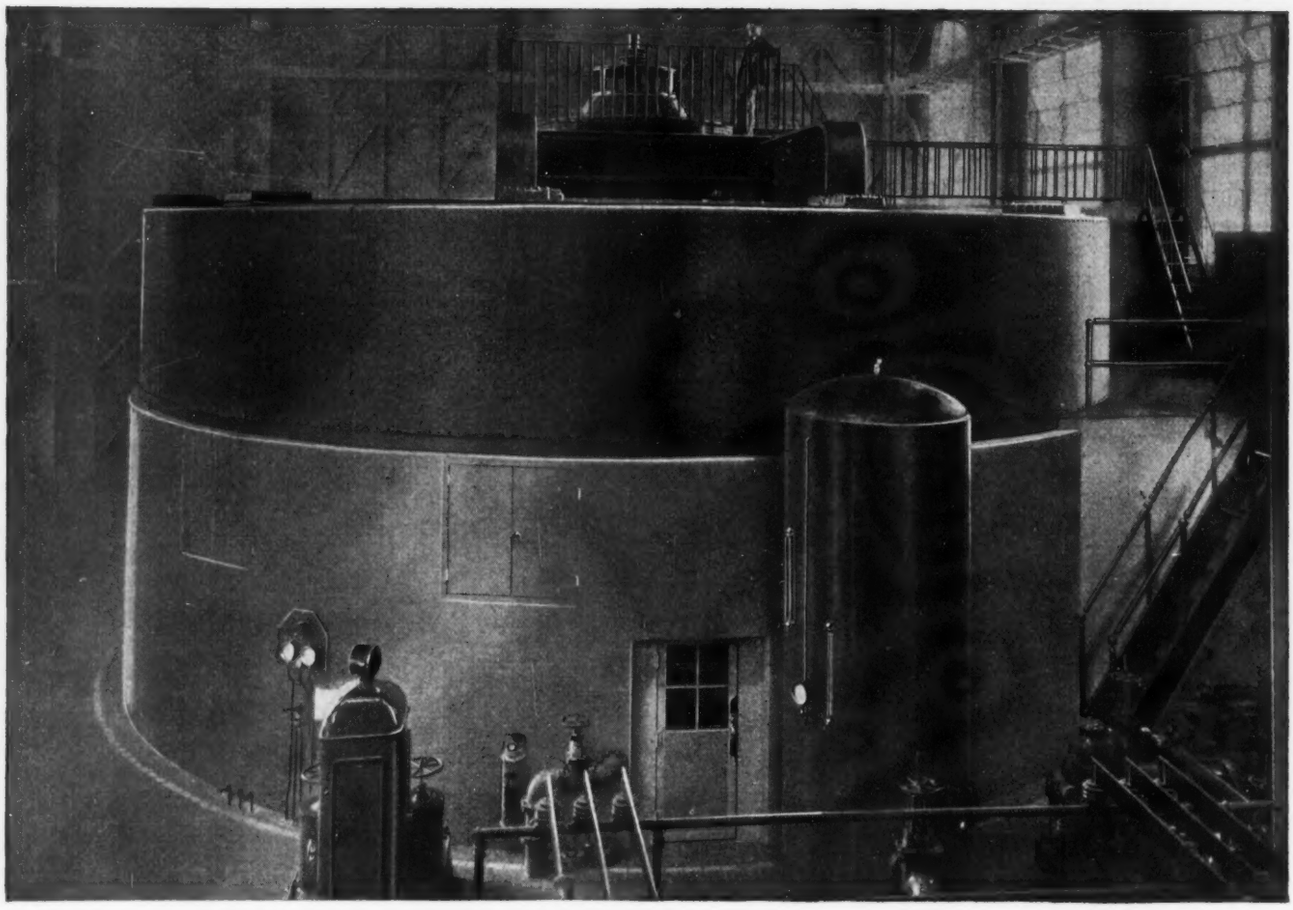

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57,000 hp. — 47,000 kv-a. — 81.8 rpm.

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Large physical size makes this one of the outstanding installations of the present time. This machine is capable of taking the entire normal flow of the upper Hudson River.

Its reliability and superior operating characteristics are typical of G-E design. Unequalled accessibility to all parts requiring inspection or maintenance is also an outstanding feature.

100-17

GENERAL ELECTRIC MANUFACTURES A COMPLETE LINE OF WATERWHEEL GENERATORS—62.5 kv-a. to 77,500 kv-a.

GENERAL ELECTRIC

Why Take the Blame *for the* Weakness *of* Old Fashion Fuses?

. . . when you can Fortify the Plant against needless shutdowns with a MODERN FUSE?

WHY let the plant worry and fret along with old fashion fuses that so often blow on temporary or harmless overloads? Why not put the blame, where it belongs, on the unsatisfactory short time-lag feature of such fuses?

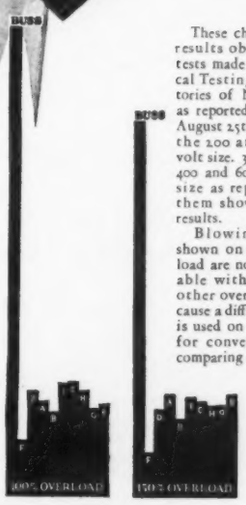
Why have machines stall and men stand idle when you can get the new BUSS SUPER-LAG Fuse—a fuse built to prevent needless shutdowns—a fuse with a time-lag far in excess of any other?

Glance at the fuse on the right. Note the "Lag-Plates" attached to the link. Observe the charts. See for yourself how this MODERN FUSE compares to old fashion fuses. Think how many costly shutdowns can be eliminated by this new fuse.

Why shouldn't you make use of the NEW BUSS SUPER-LAG FUSE—and forget fuseing trouble? The plant will take a new lease on operating efficiency, out-of-service losses will be decreased and fuse bills reduced.

Ask for the booklet "The Story of the BUSS SUPER-LAG FUSE"—or if you prefer we will have a representative call.

BUSSMANN MANUFACTURING COMPANY, ST. LOUIS, MO.
A Division of the McGraw Electric Company



Blowing Time of BUSS SUPER-LAG Fuse Compared to other makes

These charts show results obtained in tests made by Electrical Testing Laboratories of New York as reported by them August 25th, 1930 on the 200 ampere 250 volt size. 30, 60, 100, 400 and 600 ampere size as reported by them show similar results.

Blowing times shown on one overload are not comparable with those at other overloads because a different scale is used on each chart for convenience in comparing results.

THE BUSS SUPER-LAG FUSE

LES
ALLIAGES
NICKEL-CHROME
DANS LES
FOURS
ELECTRIQUES
Vue en cours de construction d'un four électrique pour traitement thermique des petites pièces cylindriques. Sole rainurée et résistances de chauffage en «Nichrome» fabriquées par les Etablissements Driver-Harris, Neuilly-sur-Seine.
Four électrique de trempe continue et automatique pour bagues de roulements à billes. Circuits chauffants en «Nichrome» des Etablissements Driver-Harris, Neuilly-sur-Seine.
Les alliages nickel-chrome qui résistent bien à l'oxydation à température élevée tout en ayant une grande résistivité ont permis le développement du chauffage électrique par résistances et son application au traitement thermique des aciers et autres alliages.
Le chauffage électrique présente de nombreux avantages et se prête bien, en particulier, à la régulation automatique de la température.
Nos Services Techniques se feront un plaisir de mettre à la disposition des industriels intéressés leur documentation sur les propriétés et les emplois des alliages nickel-chrome pour résistances chauffantes.
CENTRE D'INFORMATION DU NICKEL
pour toutes Applications Techniques et Industrielles
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1 watt — Bulb G10

Low-wattage, long-life lamps for use on commercial voltages

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Finish — Clear, sprayed red or yellow

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Supplied in 1.0 watt for 220, 230, 240 volts

NEON GLOW LAMPS have a great variety of practical and economical uses: As night lights, guide and pilot lights in the home. In industry, as signals and pilots on electrical circuits, automatic machinery, remote controls, quiet motors. In laboratory, as stroboscopes, oscillators, etc. Fit standard socket. Average life, 3,000 hours. Extremely economical! Write for prices and details to General Electric Vapor Lamp Company, 805 Adams Street, Hoboken, New Jersey.

GENERAL ELECTRIC VAPOR LAMP COMPANY

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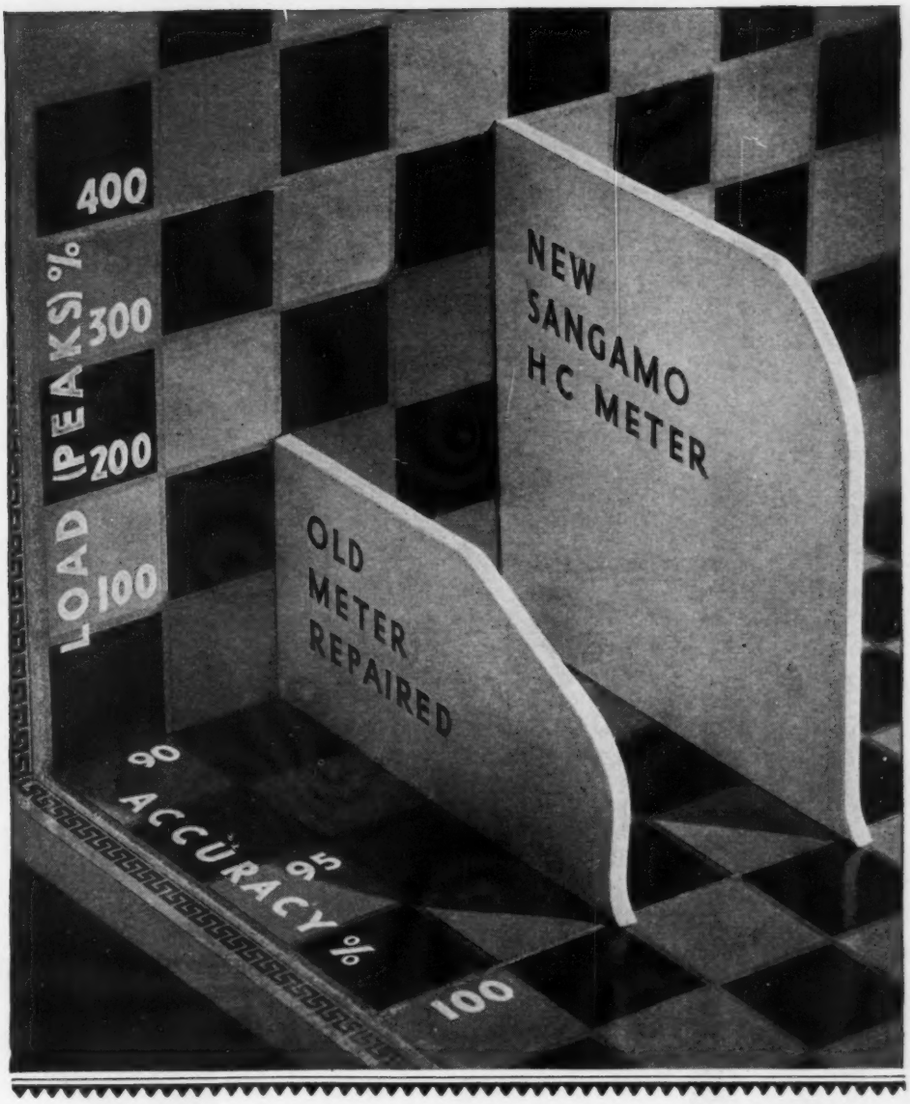

Why... REPAIR OLD METERS?

Why spend money to keep old meters in service if you need new meters for installations where the load peaks exceed 100% accuracy range of the old meters? Modern meters have three times the peak capacity of old-fashioned meters.

Sooner or later, every progressive electric utility will turn to modern meters because future development depends upon more-load-per-customer. Full payment for this extra service requires meters with modern overload characteristics.

As a first step in modernizing service meter equipment, many companies have abolished the repair of old-fashioned meters and are replacing with modern meters. The modern meters are placed in those locations where appliance loads are growing fastest.

Avoid the maintenance of obsolete equipment. Adopt a replacement program. Use the Sangamo HC . . . the more-load-per-customer meter. It has a straight-line accuracy from the lightest up to 300% load and is temperature-compensated from 20 to 120 deg. F. at all power-factors. While loads are building, the HC will measure the peaks and thus, without loss of revenue, bridge the gap to the final load which will require a larger meter.

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ELECTRIC COMPANY

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Power Cable Failure

SOME engineers having occasion to use some of the smaller ROCKBESTOS wires such as magnet wire, may not realize that ROCKBESTOS makes cables up to 2,000,000 C.M. and for voltages up to 7500.

A number of central stations, steel mills, cement plants and large industrial plants in other lines are using these cables wherever it is necessary to place power feeders in hot locations or where other deteriorating conditions make it desirable to use a non-deteriorating insulated cable to insure uninterrupted service.

The ROCKBESTOS A.V.C. insulation on these cables is a combination of non-deteriorating felted and impregnated asbestos sheath over and under high grade varnished cambric of the proper thickness for the voltage involved.

The cambric is hermetically sealed away from air and the entire insulating wall is permanently flexible even under continuous high temperatures.

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Compounds, Waxes & Paints
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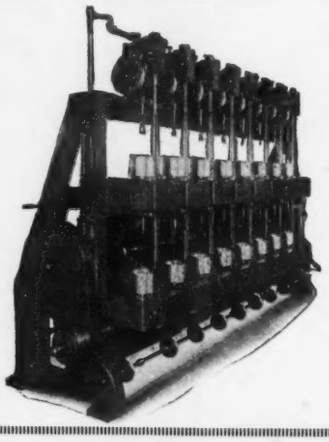

Model 2 D-8 BB
Double Cover Cotton Insulating Machine

HIGH-SPEED BALL-BEARING SPINDLES. Flyers dynamically balanced, operating at 600 R.P.M.

Insulates wire No. 15 to 25 B & S Gauges.

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. . . . *because it's seamless and bias cut*

Pull as hard as you wish on Empire Tape—it's seamless for the full length and can't come apart at the wrong time, or at any time. Another point is that it's bias cut and wraps smoothly and evenly without the least difficulty.

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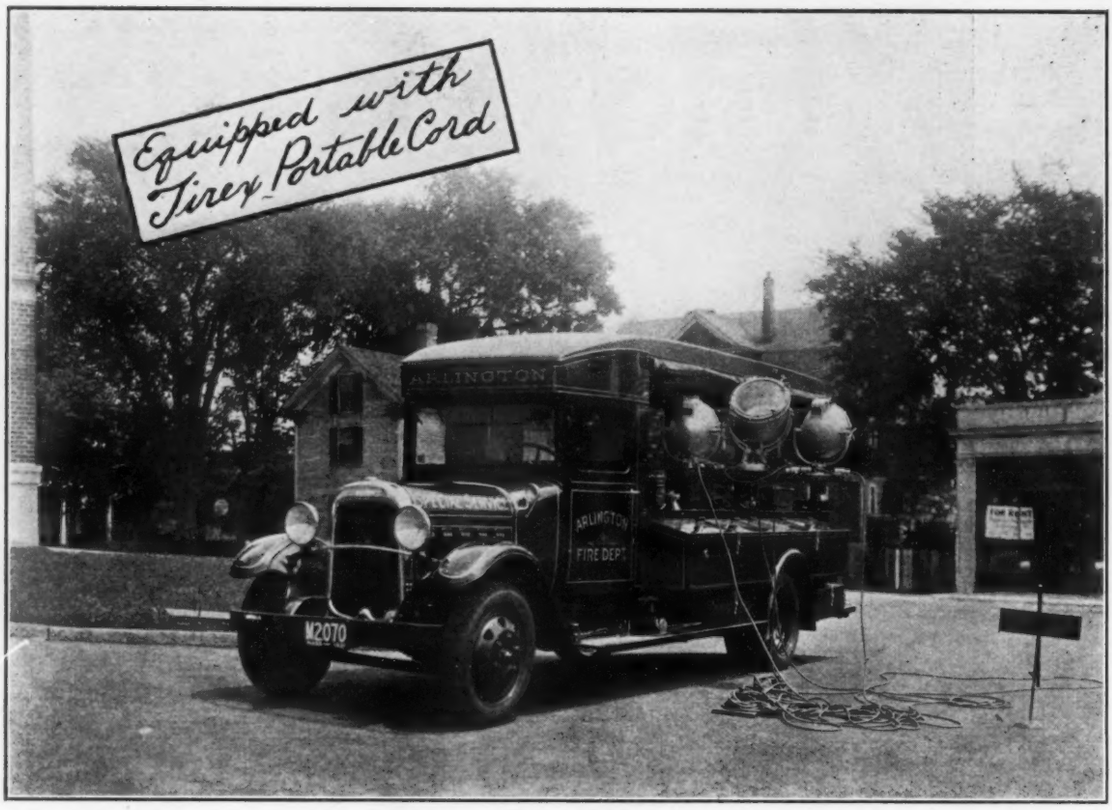

Fire truck floodlights need good cord

The emergency fire truck shown in the photograph carries three powerful, portable floodlights and connected to each is a long length of TIREX Cord so that the lights may be placed to best advantage when in use.

TIREX Cord is particularly suitable for this type of work because of its dependability under unusual or emergency conditions. It is waterproof and oils, acids, greases and alkalies have little, if any, effect upon it. TIREX is extremely flexible and will not kink, fray nor crack.

Exposure to the elements is a good test of any cord and where TIREX has been exposed to all sorts of weather conditions it has given the same satisfactory service as on indoor work.

The outstanding feature in the construction of TIREX Cords is the special outer sheath of "selenium rubber," the toughest, most wear-resisting, longest-lived rubber compound made. "Selenium rubber" protects every foot of TIREX Cord and insures uninterrupted, trouble-free performance. The process of curing rubber compounds with selenium was developed in the Simplex Laboratories and is covered by U. S. patents.

Write for the booklet "TIREX Portable Cords and Cables."

SIMPLEX WIRE & CABLE Co

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The dependability of electrical apparatus is determined often by the quality of its insulating materials. General Electric, to insure this dependability, manufactures the Insulating Materials used in its many products. These same Insulating Materials that are manufactured, used, and recommended by the General Electric Company, can be obtained from your nearest General Electric Merchandise Distributor. See him, or write Section M-409, Merchandise Department, Bridgeport, Connecticut.

GENERAL ELECTRIC

INSULATING MATERIALS

MERCHANDISE DEPARTMENT, GENERAL ELECTRIC COMPANY, BRIDGEPORT, CONNECTICUT

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The Shape of your hands and WILSON'S Curved-Finger Electrician's Gloves

Look at your hands in their most comfortable position. Then look at the shape of Wilson's Curved-Finger Electrician's Gloves.

You will see why these gloves are more comfortable, less tiring, more likely to be worn, and in every way —all the time—SAFER to wear.

Add to the "Curved-Finger" feature, the Tapered Finger Tip and also the Pure Gum Center in certain types and you will see why Wilson's Electrician's Gloves are so popular with both linemen and executives of the Power companies.

Send for New catalog of the complete Wilson line of Electrician's Gloves.

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Specialists in RUBBER GLOVES *and the* WORLD'S LARGEST MANUFACTURERS

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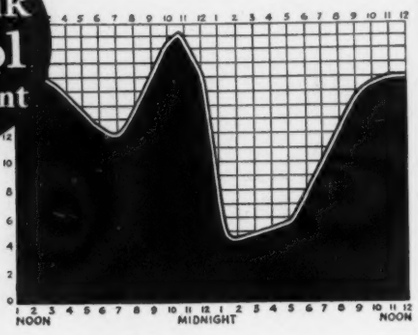
Off Peak Control Equipment



Time Switches

for control of consumption of hot water storage heaters as to peak and off-peak hours in conjunction with the thermostatic control of the hot water heater.

2-Rate Meters
(Single and Polyphase)

for metering the consumption during peak and off-peak hours, separately distinguishable by ONE METER ONLY.

3-Rate Meters
(Single and Polyphase)

for metering the consumption during peak off-peak and night hours separately distinguishable by ONE METER ONLY

Know the largest line of electricity meters in the world, covering the complete field of special metering equipment, in addition to watthour meters, time switches and electric clocks.

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METERS AND TIME SWITCHES

104 FIFTH AVENUE, NEW YORK, N. Y. Herbert Nehls, *Vice-Pres. and Gen. Mgr.*

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For all classes of ground resistance tests

BORDEN ELECTRIC CO.

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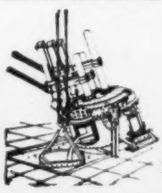
DETROIT ELECTRIC FURNACES
will
Build Power Business
for
THE CENTRAL STATION
Let us help increase your revenue
Detroit Electric Furnace Co.
825 W. Elizabeth St., DETROIT



Moore Rapid Lectromelt Furnaces

Ten Standard Sizes ½ to 24 Tons Capacity
Most Rapid and efficient for making
Tool Steels, Alloy Steels, Forging Steels
Steel Castings, Malleable Iron, Grey Iron
Carbide, Ferro-Alloys etc.

PITTSBURGH ELECTRIC FURNACE CORPORATION
P.O. Box 1125. PITTSBURGH, PA.

RUGGED DISC INSULATORS

"PROTECT WITH JD TO A GREATER DEGREE"

JEFFERY-DEWITT INSULATOR CO.
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THICKER PORCELAIN FOR POWER TRANSMISSION SERVICE.

REDUCE those —power BILLS!

Use AmerTran Air-Cooled Balancing Coils to step down 220-volt power circuits to 110 volts for lighting, heating, and small motors . . . . . .

Operating costs may be reduced materially by the use of AmerTran Air-Cooled Balancing Coils . . . in industrial plants and commercial buildings they are used to supply 110 volts for lighting, heating devices, and motor-driven appliances from 220-volt power circuits . . . they make it unnecessary to pay a higher KW. rate on the lighting load.

AmerTran Balancing Coils are smaller and more efficient than double-wound transformers of equivalent capacity. Also, because they are air cooled, there is no maintenance expense and a fireproof vault is not required. All standard sizes are equipped with conduit fittings and are suitable for installation either outside or indoors.

If you are interested in reducing your electric bills, send for Bulletin No. 1115. This contains specifications and prices on all standard AmerTran Balancing Coils in sizes from 1 to 15 kva. It also describes double-wound transformers which may be used for the same purpose on 220-, 440-, or 550-volt power circuits.

AMER TRAN

AMERTRAN TRANSFORMERS

Manufactured by—AMERICAN TRANSFORMER COMPANY

170 Emmet St. Newark, N. J.

15 KV. 1200 Amp.

Elpeco Indoor Switch

—with special tube lug terminals

ELECTRIC POWER EQUIPMENT CORP.

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For Electrical Specialties

IMPERIAL PORCELAIN WORKS Inc.

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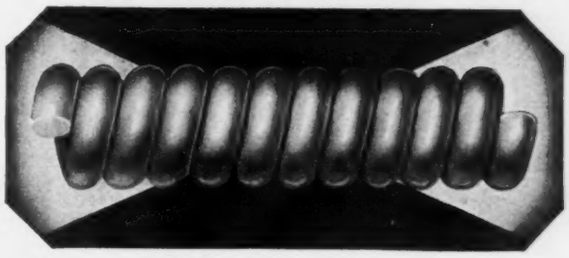

Galvanized Telephone Wire and Steel Strand

Crapo Galvanized Wire can be wrapped around its own diameter without injury to its pure zinc coating....That is one of a number of reasons why **Crapo** Galvanized Telephone Wire and Strand can be depended upon to reduce maintenance cost.

Look for the **Crapo** Seal!

Indiana Steel & Wire Co.

Muncie, Indiana

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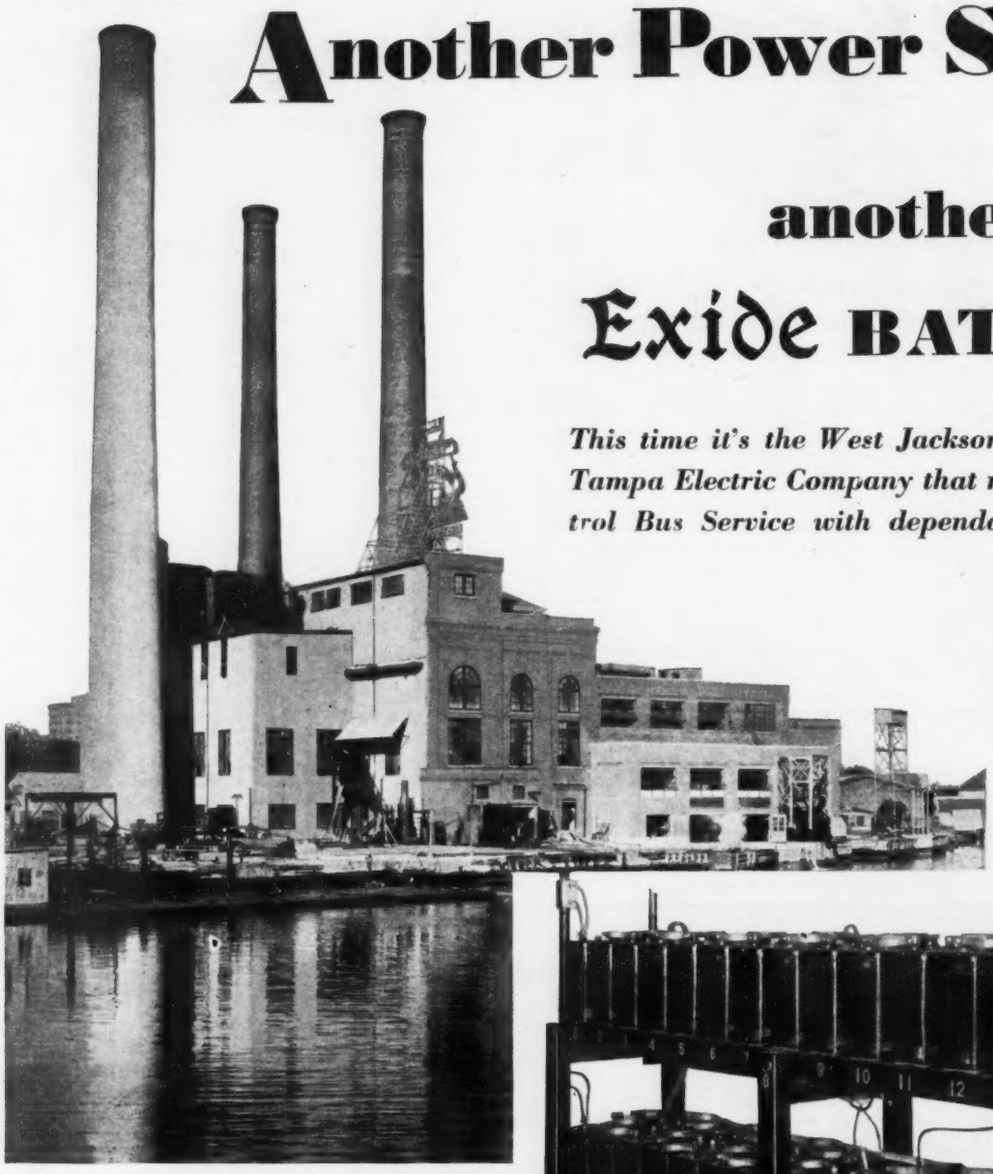
Crapo GALVANIZED PRODUCTS

Another Power Station-

another

Exide BATTERY

This time it's the West Jackson Street Station of Tampa Electric Company that makes sure of Control Bus Service with dependable 60-cell Exide



West Jackson Street Station of the Tampa Electric Company, Tampa, Fla., looking S.E. This 35,500 Kva generating capacity station makes Control Bus Service certain with a 60-cell Exide Battery. The Stone & Webster Engineering Corp. were its engineers and builders.

• • •

This 60-cell Exide Control Bus Battery is typical of the one used by the Tampa Electric Company to safeguard its Control Bus Service.

FROM Puget Sound to Florida, from Maine to California, you'll find Exide Batteries guarding control bus and emergency station lighting service year in and year out. The Tampa Electric Company's West Jackson Street Station adds another to the long list of Exide Control Bus Battery installations.

This continued preference for Exide Batteries is not just a coincidence. It's the absolute dependability, long life and economy of operation that make Exide the battery specified repeatedly for power stations and manufacturing plants.

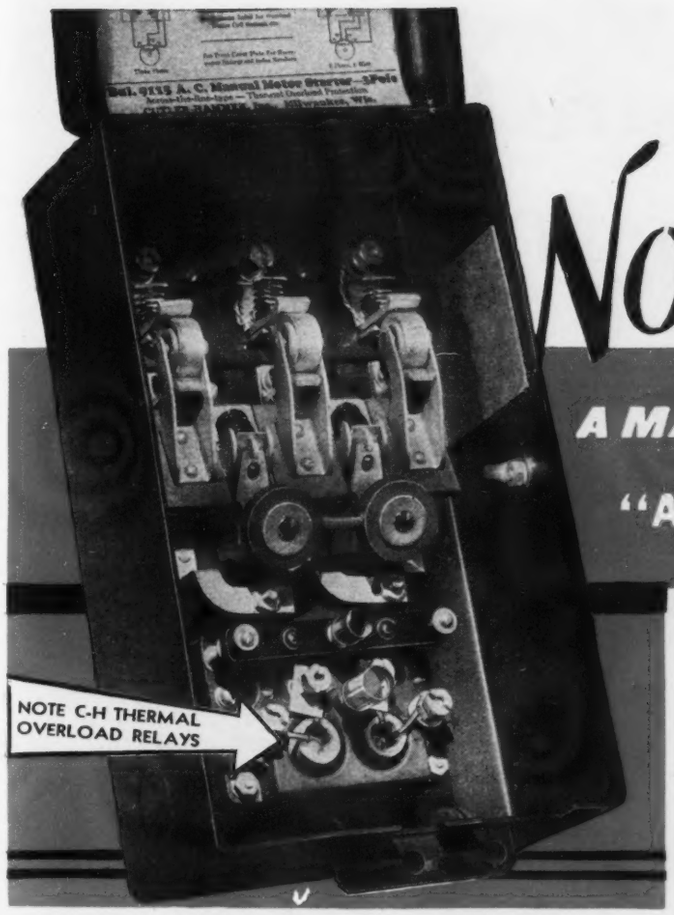
Remember this—when you buy an Exide Battery you are buying 43 years' battery-building experience. This assures you of absolute battery dependability and economy.

Exide
BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia

THE WORLD'S LARGEST MANUFACTURERS OF STORAGE BATTERIES FOR EVERY PURPOSE

Exide Batteries of Canada, Limited, Toronto



The new C-H 9115 Manual Starter for motors up to 7 1/2 H. P.

Now

A MANUAL STARTER THAT'S "ALL BUT" AUTOMATIC

BUILT with the famous C-H Thermal Overload Relay, this newly designed Manual C-H 9115 A. C. "X" Starter for motors up to 7½ h. p. provides all the advantages of an automatic starter except the remote control feature itself. The overload is so accurate that it keeps the motor on the line right up to the danger point but always on the safe side. Maximum production is kept up, safety is maintained, production interruptions are cut to the minimum.

The C-H 9115 Manual Starter *cannot* single-phase a motor, always cuts it entirely off the line; tripping of either overload element opens all phases; the overload relay is reset from the *outside* by the operating handle which starts, stops and resets . . . there is no extra resetting lever and nothing to renew. Read details at left. You'll find the features you want in a manual starter and many you didn't expect.

Electrical wholesalers in principal centers stock this and other types of C-H Control, ready for service on your motors. Demand C-H Control also on every motorized machine you buy. For details write CUTLER-HAMMER, Inc., *Pioneer Manufacturers of Electric Control Apparatus,* 1285 St. Paul Avenue, Milwaukee, Wis.

Here's Everything You Want in a Manual Starter

1. Mechanism is heavy duty, built to C-H Motor Control standards. Moulded Thermoplax base. Cover interlock; cannot be opened when current is on. Can be padlocked. Ratings: up to 5 h. p., 220 volts; up to 7½ h. p., 440-550 volts, A. C.

2. Famous C-H Overload Relay, noted for accuracy. Drives motors to full safe limit.

3. Cannot single-phase motor; tripping either overload element opens all phases.

4. Free-tripping; cannot be closed on overload.

5. Overload relay resets from without. Nothing to replace or renew. Heater coils interchangeable for different ratings and with heaters of other C-H Starters.

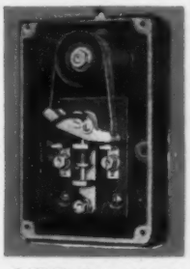
6. Starting lever resets relay as well as starts motor —no extra levers or buttons to operate.

7. Overload trip indicator shows whether motor has been disconnected by overload relay or whether trouble is elsewhere in circuit.

8. Quick double make, quick double break contactors halve the voltage rise, give far longer service.

To make your investment complete—and SAFE

Your investment in Motor and Motor Control is no more complete—and no more safe—without *dependable* accessories than an automobile is without *dependable* brakes. Use C-H Accessories —(push buttons, limit switches, etc.) They match C-H Motor Control in dependability and long life.



C-H Bulletin 10256, Plugging Relay, for quick stopping of A.C. Motors—for use with automatic reversing starters and speed regulators.

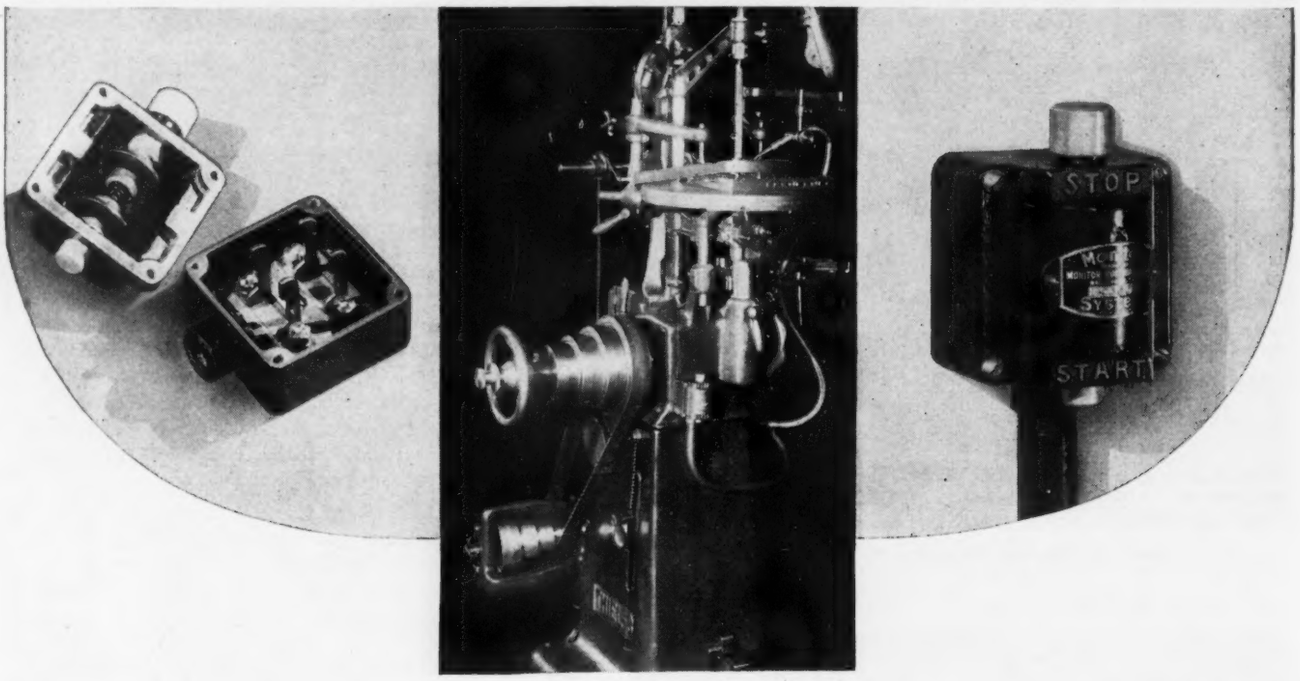
CUTLER HAMMER

C-H

The Control Equipment Good Electric Motors Deserve

A-3974

Safe and Sure Control for Modern Tools



This tool-makers' precision machine is equipped with Monitor control. The perfection of detail in Monitor control system is here evidenced by the control station. Doesn't it look up to the workman-like aspect of the machine upon which it is mounted?

It is husky . . . all external parts are metal for strength and wear . . . hence its name Ironclad. No horizontal projections to break off. The start button is protected from accidental pressure by its location, while the stop button is made particularly accessible.

The internal construction is even more impressive. The cover carries all the movable parts of the switch. The stationary contacts are securely fastened to a heavy insulating block screwed to the base. The contacts are double-break. They are made with heavy self-seating copper disks applied with perfectly equalized spring pressure. All working parts are extremely simple and husky in construction.

The Ironclad is a perfect station for machine tools . . . it is water-proof, accident-proof, quick-acting and can be installed for conduit entrance on any one of four sides.

Monitor specializes in custom-built controllers, made with standardized parts at prices competitive with mass-designed ready-to-use controllers.

MONITOR CONTROLLER COMPANY

Gay, Lombard and Frederick Streets, Baltimore, Md.

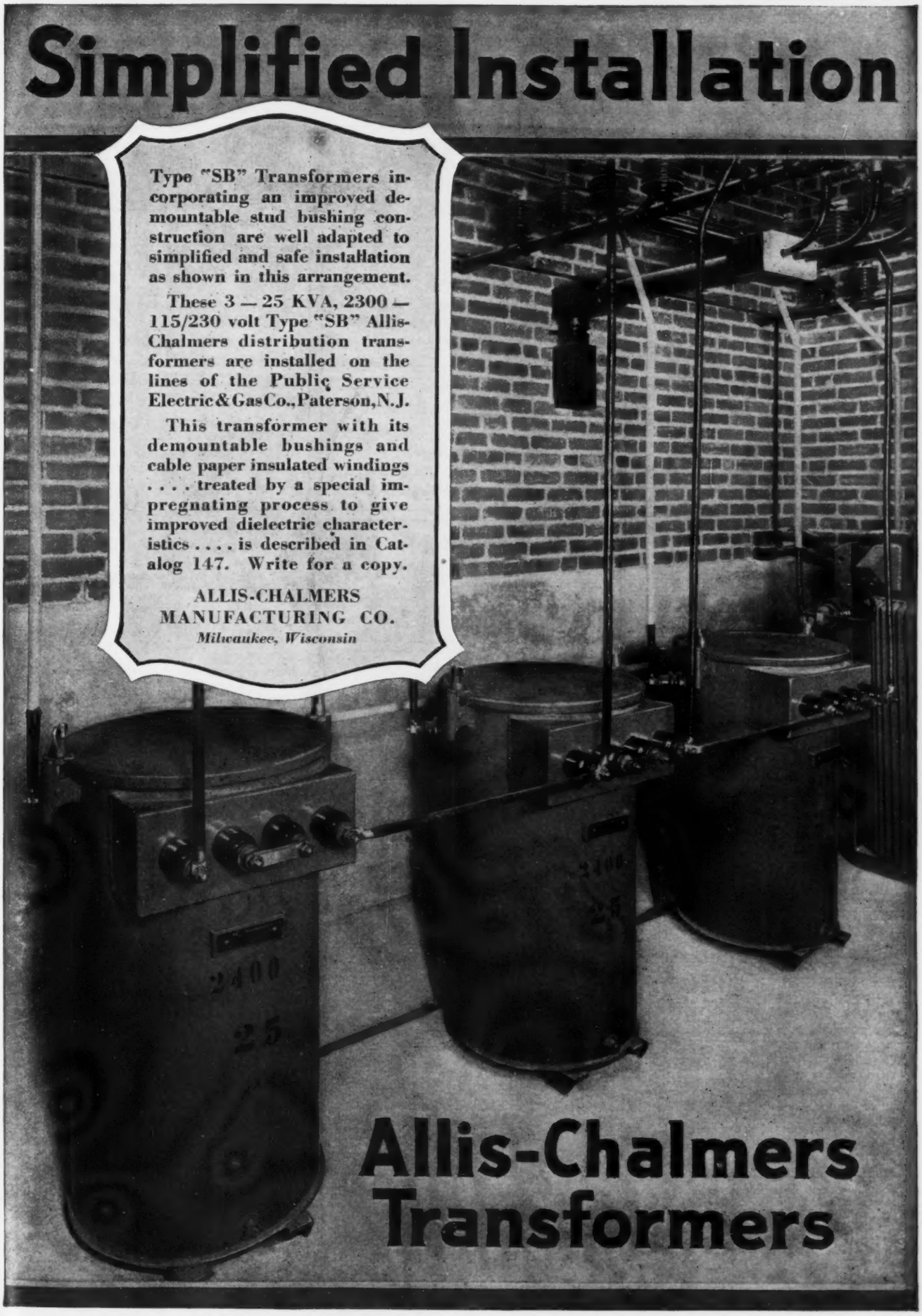
BRANCH OFFICES IN PRINCIPAL CITIES

IF YOU HAVE A CONTROL PROBLEM . . . CONSULT MONITOR

Monitor

DOES IT *AUTOMATICALLY*

Simplified Installation



Type "SB" Transformers incorporating an improved demountable stud bushing construction are well adapted to simplified and safe installation as shown in this arrangement.

These 3 — 25 KVA, 2300 — 115/230 volt Type "SB" Allis-Chalmers distribution transformers are installed on the lines of the Public Service Electric & Gas Co., Paterson, N.J.

This transformer with its demountable bushings and cable paper insulated windings . . . . treated by a special impregnating process to give improved dielectric characteristics . . . . is described in Catalog 147. Write for a copy.

ALLIS-CHALMERS
MANUFACTURING CO.
Milwaukee, Wisconsin

Allis-Chalmers Transformers

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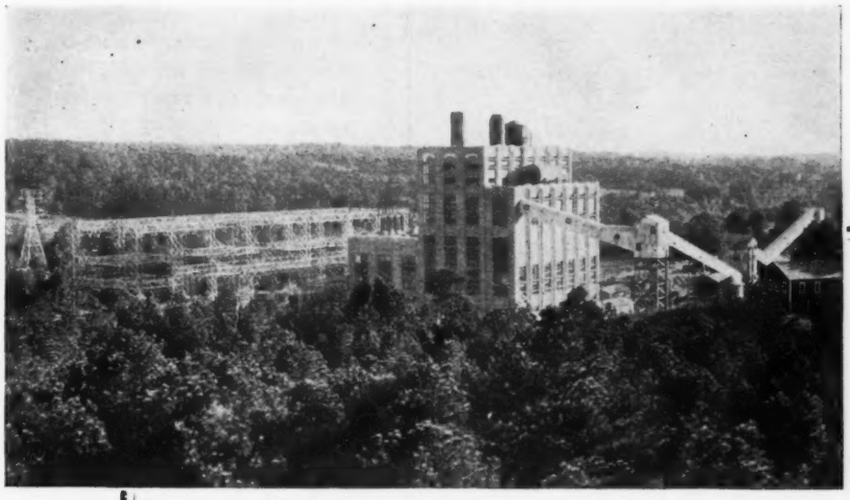

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E.W.

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IF YOU are qualified for position between $2,500 and $25,000, and are receptive to negotiations for new connection, your response to this announcement is invited. The undersigned provides a thoroughly organized service established twenty-one years ago, to conduct confidential preliminaries, and assist the qualified man in locating the particular position he desires. Not a registration bureau. Retaining fee protected by refund provision, as stipulated in our agreement. Send name and address only for description of service. R. W. Bixby, Inc., 263 Main Street, Buffalo, N. Y.

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DISTRIBUTION engineer, desires position with Public Utility in United States or Foreign Service. Experienced in underground or overhead distribution, transmission, substation, meter department, estimating, organizing and supervision. Reference as to ability given on request. PW-933, Electrical World, Tenth Ave. at 36th Street, New York.

ELECTRICAL engineer available, age 31, single. Eight years' varied experience with large utility. College graduate. Location immaterial. Utility or sales position desired. PW-925, Electrical World, Tenth Ave. at 36th St., New York.

TECHNICAL trained electrical man, 36, experienced handling men in service shops of large electrical manufacturers. Will present plan for accepting deferred salary for year. PW-932, Electrical World, 883 Mission St., San Francisco, Calif.

MANAGING mechanical and electrical engineer with twenty years' practical experience constructing and operating light, power, street railway and waterworks systems. Fifteen years with one of largest public utility companies in America. Six years in South America as manager in charge construction and operation. Have been successful in taking over non-profitable light and power companies and placing them on paying basis. Can make confidential reports on economical operating conditions of public utilities for executives. Best of references and will go anywhere. PW-934, Electrical World, Tenth Ave. at 36th Street, New York.

U. S. Government

TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., Sept. 14, 1931—Sealed Bids in duplicate subject to the conditions contained herein will be publicly opened in this office at 2 p.m., Oct. 12, 1931, for furnishing all labor and materials and performing all work for fire alarm system at the extension 1929 U. S. post office, court house, etc., Brooklyn, New York. The prevailing rate of wage shall be paid all laborers and mechanics employed on the project as provided in the Act or March 3, 1931, (Public No. 798). Drawings and specifications may be obtained from the custodian at the building or at this office in the discretion of the supervising architect. JAS. A. WETMORE, Acting Supervising Architect. (262)

AGENCIES WANTED

Electrical Engineer, 20 years' sales and executive experience, financially responsible, desires to represent manufacturers in California and Arizona.

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A CONCISE, comprehensive course for men of ambition, complete in one year. Mathematics engineering drawing, shop-work. Students construct motors, install wiring, test electrical machinery. Fireproof buildings. 38 years' successful experience. Catalog on request.

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U. S. Government

U. S. DEPARTMENT of Agriculture, Bureau of Public Roads, Washington, D. C., September 18, 1931.—Sealed Bids will be received at the office of the Bureau of Public Roads, Washington, D. C., until 11 o'clock a.m., on October 15, 1931, for Unit V of the Mount Vernon Memorial Highway, consisting of lighting. Unit V begins at the south shore of Roaches Run in Virginia, and ends at the entrance to the Mount Vernon Estate, and consists of 130 single light metal standards, 335 single light cedar standards, 2 double light cedar standards, 121 erection of metal standards, 313 erection of cedar standards, 327 precast concrete transformer vaults, 121 individual light transformers for metal standards, 315 individual light transformers for cedar standards, 315 equipment on cedar light standards, 121 lighting fixtures for metal standards, 315 lighting fixtures for cedar standards, 133,000 linear feet armored Parkway cable, No. 8 single conductor. Plans, specifications and proposals may be obtained at the office of the Bureau of Public Roads, Willard Building, Washington D. C. THOS. H. MacDONALD, Chief of Bureau.

SEALED PROPOSALS will be opened by the Supt. of Lighthouses, 12th District, 424 Federal Bldg., Milwaukee, Wis., 2 p.m., September 30, 1931, for submarine electric cables for installation by U. S. in Carter Harrison Crib Tunnel, Chicago: 15,000 ft. signal cable and 15,000 ft. 4,000-volt power cable. Information upon application. (261)

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If it is a Position Wanted or Position Vacant ad, make the first word the kind of position sought or offered.

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1—200-hp. West., CS, Sq. Cage, 220/440 v., 580 r.p.m.
1—200-hp. West., CW, Slip Ring, 440/220 v., 500 r.p.m.

SYNCHRONOUS ROTARY CONVERTER
1—165 kw. G.E. Type HCC, D.C., 250/125 v., A.C. 6 ph., 60 cy., 1200 r.p.m., with 2300/4150 volt Transf. and S/B.

GASOLENE ENGINE-GENERATOR
1—85-hp. Sterling 4 cyl., 1200 r.p.m. Eng., dir. coupled to 50 kw. Gen.

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there is anything you want—

or something you don't want that **other** readers of this paper can supply — or use — advertise in the

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Somebody is always looking for something to meet certain business needs. Some men in charge of plant operations may be in the market for good used equipment — others may have just what they want, to sell. Some may require a man of unusual qualifications for a particular position — that man may be another reader of this paper!

Put the Searchlight Section to work for you, to fill your business needs.

J. L. HEMPHILL & CO. Inc.
ELECTRICAL ENGINEERS AND EQUIPMENT
807 Williams St. North Bergen, N. J.

Telephones: Palisade 2600-2601

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1—500 kw., 250 v. Westinghouse Synchronous motor Generator Set.
2—300 kw., 250 v., 1200 r.p.m., 4100 v., General Electric Synchronous Motor.
1—250 kw., 230 v., 3 ph., 60 cy., 2300-4600 v. Synchronous Motor Generator set.
1—200 kw., 230 v., 3 ph., 60 cy., 2300-4100 v Synchronous Motor Generator set.
1—150 kw., 600 r.p.m., 250 v., Gen., 3 ph., 60 cy., 220-440 v., G. E. Synchronous motor.
1—125 kw., 250 v. Westinghouse Synchronous Gen. Motor Set, 3 ph., 60 cy., 230-2200 v.
1—100 kw., 125 v., D. C. 220-440 A.C. G.E. Synchronous Motor Generator Set, 220-440 v
1—100 kw., 250 v. Gen., 900 r.p.m., 2200 Synchronous Motor

Smaller on request.

TURBINES

1—75 kva., 3 ph., 60 cy. Westinghouse Geared Non-Condensing Turbine.

TRANSFORMERS

1—1500/3000 kva. G. E. combined oil and water cooled 3 ph., 60 cy., 11000-22000-2300 v.
4—333 kva. Pittsburgh, 4160-110/220 v.

A. C GENERATORS

No.	*Kw.*	*R.p.m.*	*Volts*	*Ph.*	*Type*
1	400	900	2300/4000	3	Westg.
1	350	600	440	3	Westg.
2	125	900	2300	3	Cr.-Wh.
2	100	900	230-2300	3	G.E.
1	75	600	220	3	Westg.
1	75	900	2300	3	G.E.
1	50	1200	220-440-2300	3	G.E.

MOTORS—3 Phase, 60 Cycle

No.	*Hp.*	*R.p.m.*	*Volts*	*Type*
1	600	360	440	G.E. Syn.
1	500	900	440/4000	(Westg. Syn. Con.)
2	300	600	445-2300	G.E. syn.
1	250	600	2200/4000	G.E. syn.
1	250	600	220-440	Westg. syn
1	250	600	440-2200	G.E. syn.
3	200	514	4150-2300	G.E. syn.
2	175	3 ph.	60 cy.	2300 volts, G.E.
2	150	1200	220/440	Westg. rg.
1	150	900	2300	G.E. syn.
2	150	514	2200	Westg. sl.rg.
1	150	1800	2200	Westg. sq.cg. mtr.
1	100	900	440-2200	G.E. sq. cg.
1	100	900	220-440-220	Westg. sq. cg.

D.C. Generators

No.	*Kw.*	*R.p.m.*	*Volts*	*Type*
1	200	900	250	G.E.
1	200	600	250	G.E.
1	200	525	250	G.E.
2	150	1200	250	Cr.-Wheeler
1	150	600	250	G.E.
2	150	1200	250	Westg., new
1	100	720	250	G.E.
1	75	450	250	Dieh

(Smaller Sizes on Request)

D.C. MOTORS—230 VOLT

No.	*Hp*	*R.p.m.*	*Type*
1	250	900	G.E.
2	200	1150	Cr.-Wheeler
1	150	600	G.E.
1	150	1100	Westg. SK.
1	125	550	Cr.-Wheeler
1	100	625	Westg. Type S

(Smaller Sizes on Request)

D.C. MOTORS—125 VOLT

No.	*Hp*	*R.p.m.*	*Type*
1	125	575	G.E.
1	100	600	G.E.
1	80	600	G.E.

SLIP-RING MOTORS, 3 PH., 60 CY.

Hp.	*Volts*	*Make*	*Speed*
220	220-440	G. E.	450
200	2300-4000	G. E.	514
200	440-220	G. E.	600
150	2200-440-220	G. E.	514
150	220-440	G. E.	720
150	220-440-550	G. E.	600
100	550	Westghse.	900
100	2200	Westghse	900
100	2200	G. E.	720
100	550	G. E.	720
100	440-220	G. E.	720
100	440-220	G. E.	900
75	550	Westghse.	720
75	440-220	G. E.	600

SYNCHRONOUS MOTORS, 3-PH., 60-CY.

300	440	G. E.	225
240	2200-440	G. E.	720
150	2300-4000	G. E.	900
110	2200-550	G. E.	900
80	2200-440-220	G. E.	1200

MOTOR-GENERATOR SETS AND ROTARY CONVERTERS

1—150-kw., 250/275-v., 1200-r.p.m., G. E., connected to 225-kva., 2300-4000-v., 3-ph., 60-cy., synchronous motor.
1—145-kw., 120-v., 900-r.p.m., Westghse, connected to 285-hp., 2400-4100-v., 3-ph., 60-cy., synchronous motor.
1—100-kw., 250-v., 3-ph., 60-cy., 1200-r.p.m. Westghse., with 2300-v. transformer.
1—50-kw., 125-v., 1200-r.p.m., G. E., R. C., connected to KT, 2200-440-220-v., 60-cy., squirrel cage motor.

A. C. GENERATORS

1—225-kva., 600-r.p.m., 2200-240-480-v., G. E.
1—187-kva., 720-r.p.m., 2200-440-220-v., G. E.
1—150-kva., 900-r.p.m., 2200-480-240-v., G. E.
1—120-kva., 900-r.p.m., 2300-4000-v., G. E.
1—112½-kva., 900-r.p.m., 2200-240-480-v., G. E.
1—75-kva., 1200-r.p.m., 2200-480-240-v., G. E.
1—56-kva., 1200-r.p.m., 240-480-v., G. E.

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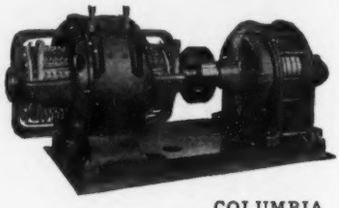

COLUMBIA
Low-Voltage Motor-Generator

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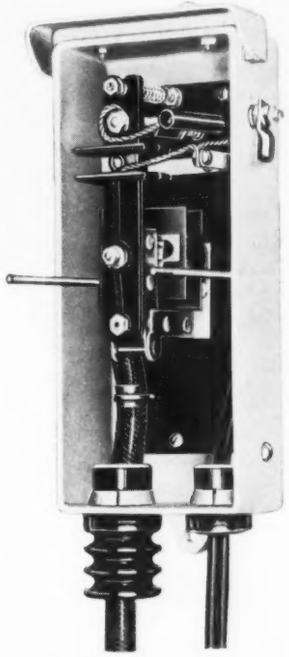

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FOR INDEPENDENT GROUPS OF MULTIPLE LAMPS

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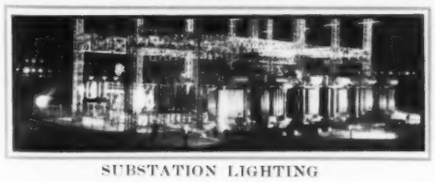
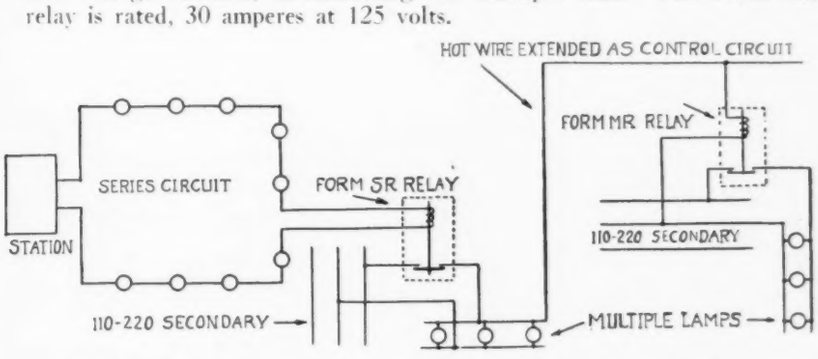


SUBSTATION LIGHTING

APPLICATION: Nearby series circuits may be utilized as an economical means of positive control for multiple lighting having the same lighting schedule as the series lighting. The diagram shows a typical layout using the Form SR relay to control up to 3500 watts of multiple lighting. For greater loads the hot wire of the multiple circuit controlled by the Form SR relay may be extended, as shown in the diagram, to serve as the control circuit for Form MR multiple relays. The Form MR relay is available in 30 and 60 ampere capacities of 125 volts.

OPERATION: The Form SR relay is magnetically operated, having the control coil connected in the series lighting circuit. Energizing the series circuit closes the low voltage contacts of the Form SR relay, connecting the multiple load. De-energizing the series circuit opens the low voltage contacts, disconnecting the multiple load. The Form SR relay is rated, 30 amperes at 125 volts.



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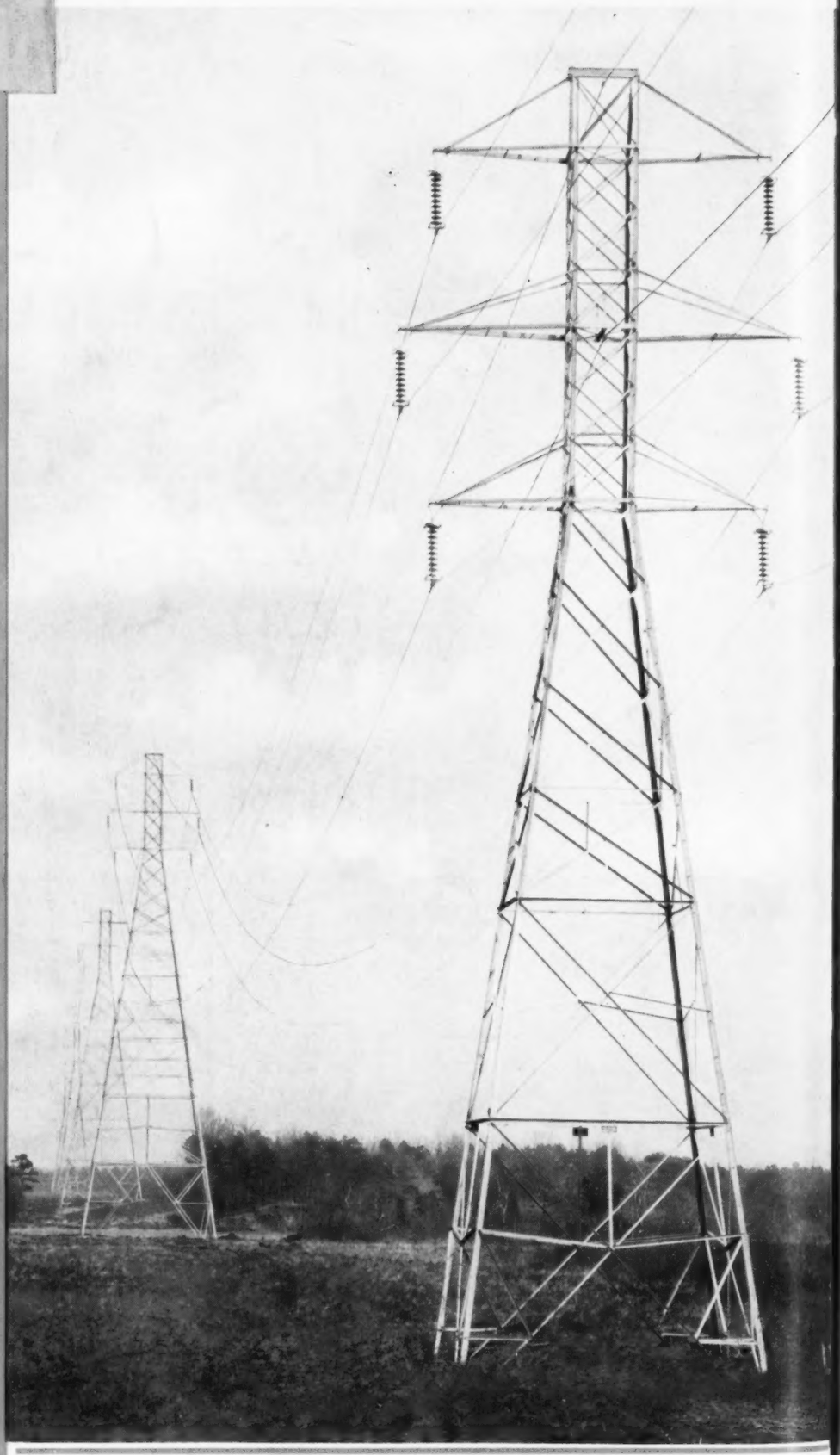

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